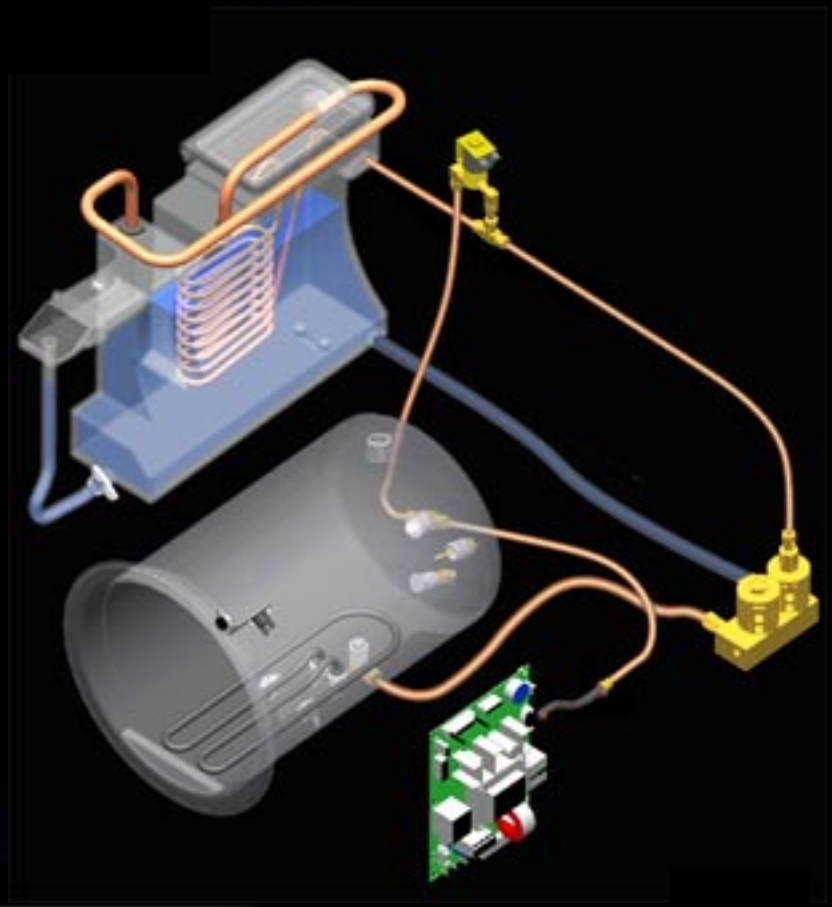
Theory of Operation



PRE-HEAT MODE | VENT MODE
FILL MODE | DRY MODE
HEAT-UP MODE | FAN SYSTEM
STERILIZE MODE | DOOR MOTOR

ISA111400

This section graphically depicts normal operation of the sterilizer.

For detailed information about the location and function of any component shown, simply click on that component. *(NOTE: This feature is not available on animated screens)*

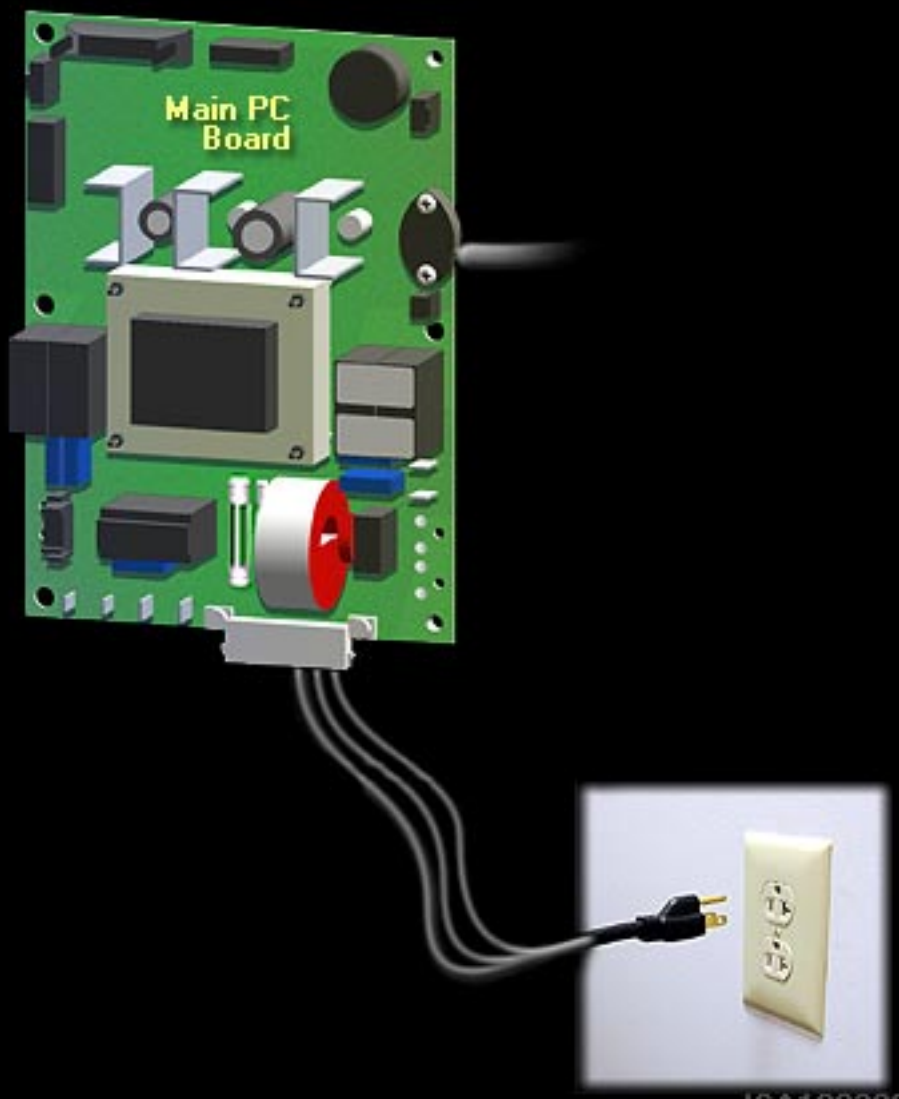
To view the Theory of Operation for a complete cycle, click on the START button.

To view the Theory of Operation for a specific mode or system, select the desired option from the menu.

Print | Error Codes

MIDMARK

Power-Up Mode

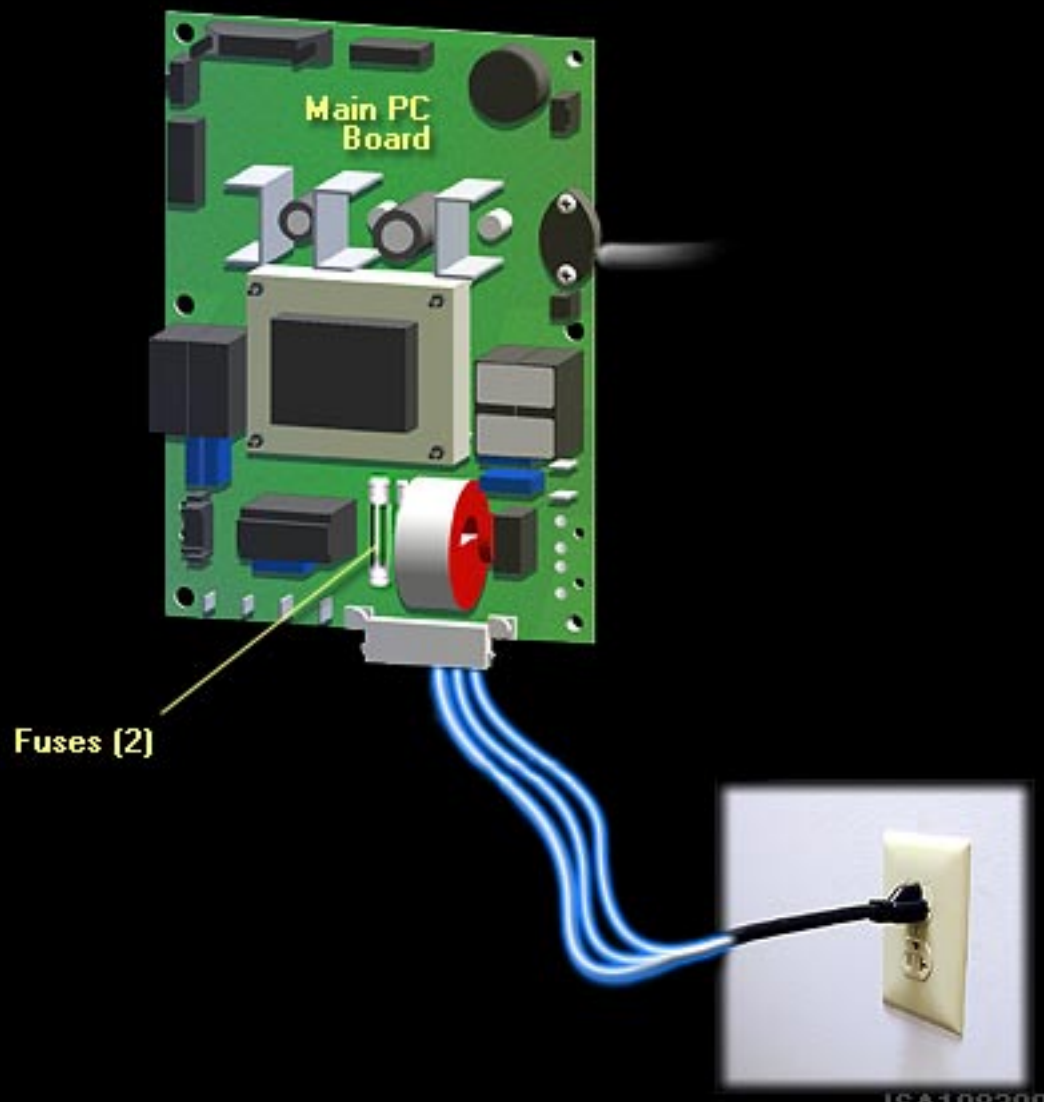


Click on the power cord to begin.

Theory Menu | Print | Error Codes | Back

MIDMARK

Power-Up Mode



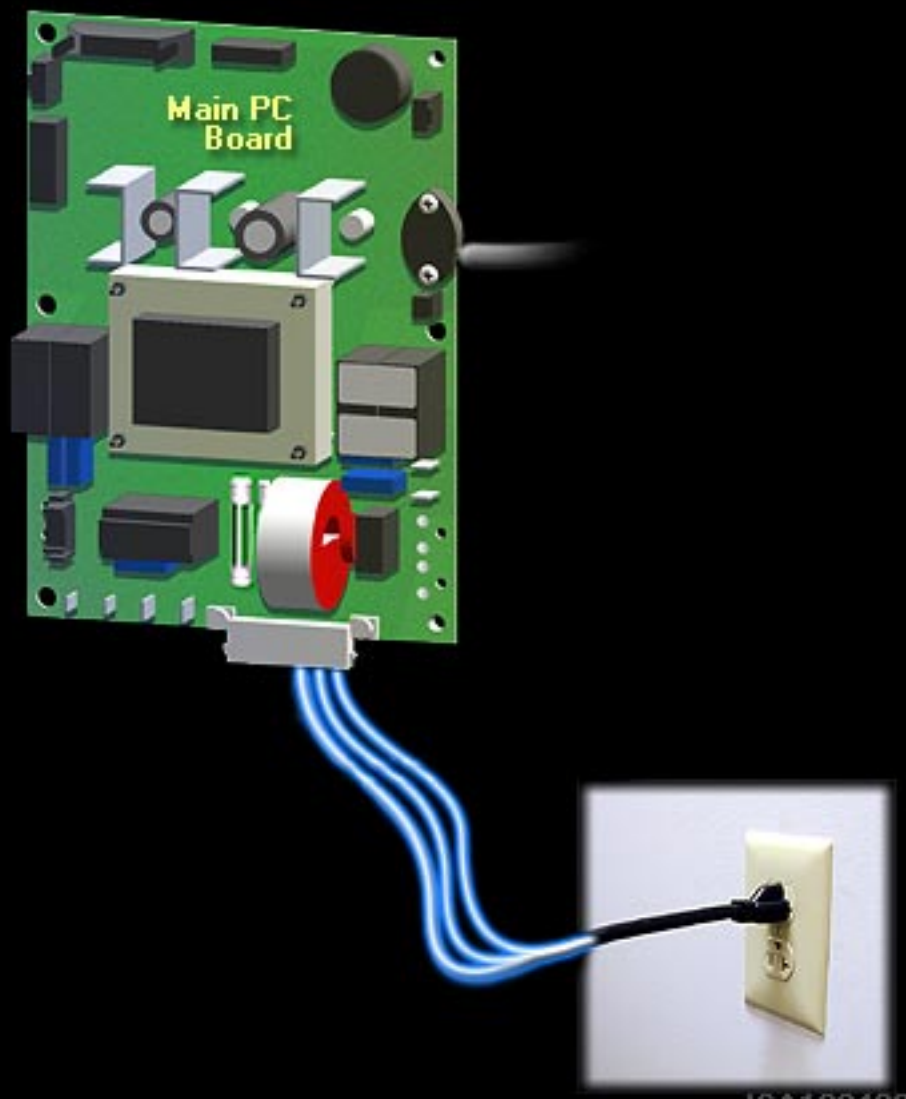
Whenever the power cord is plugged in, line voltage is supplied to the Main PC Board through two primary Fuses.

The display panel will show:

- **Total number of cycles run on the sterilizer *(ex. 15)***
- **Model number *(ex. M11)***
- **Software version number *(ex. v2.00)***

MIDMARK

Select Cycle

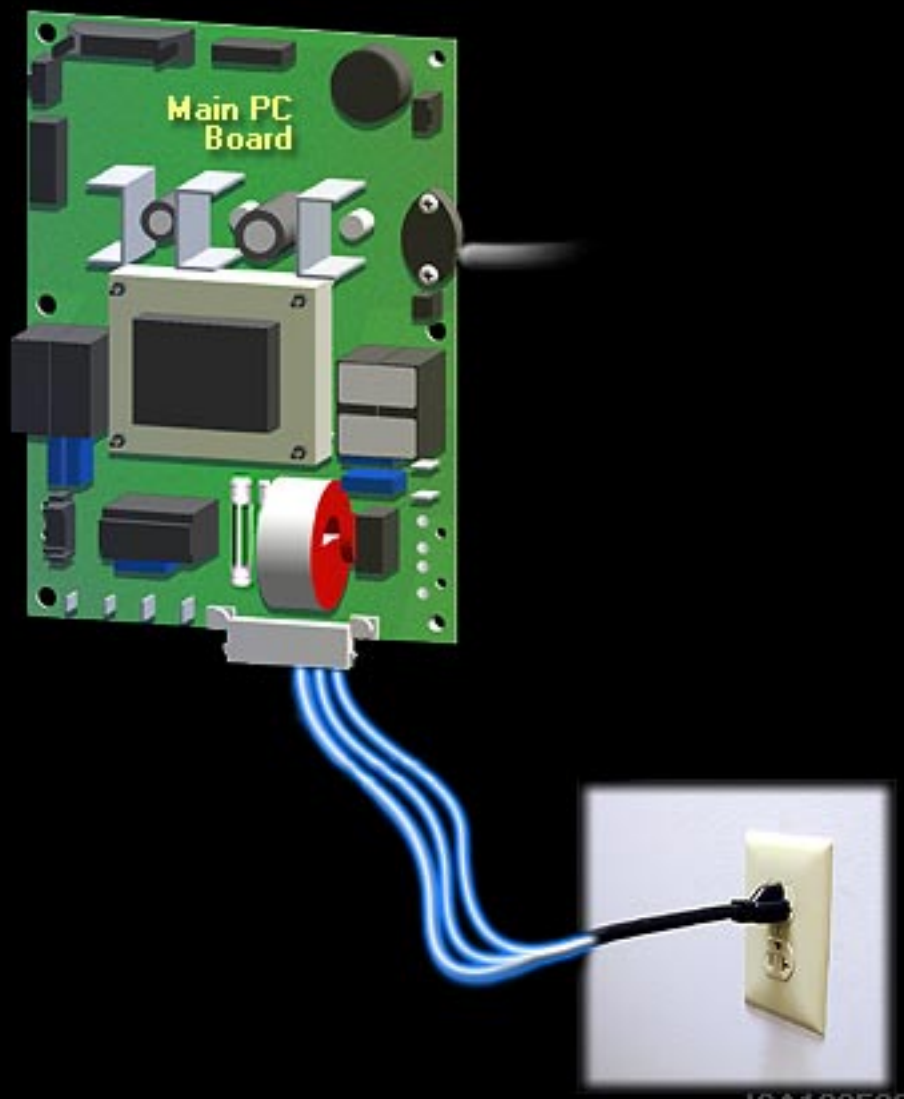


To initiate the Pre-Heat Mode:
Press the START button.

To initiate the demonstration cycle:
Press the UNWRAPPED button.

MIDMARK

Select Cycle



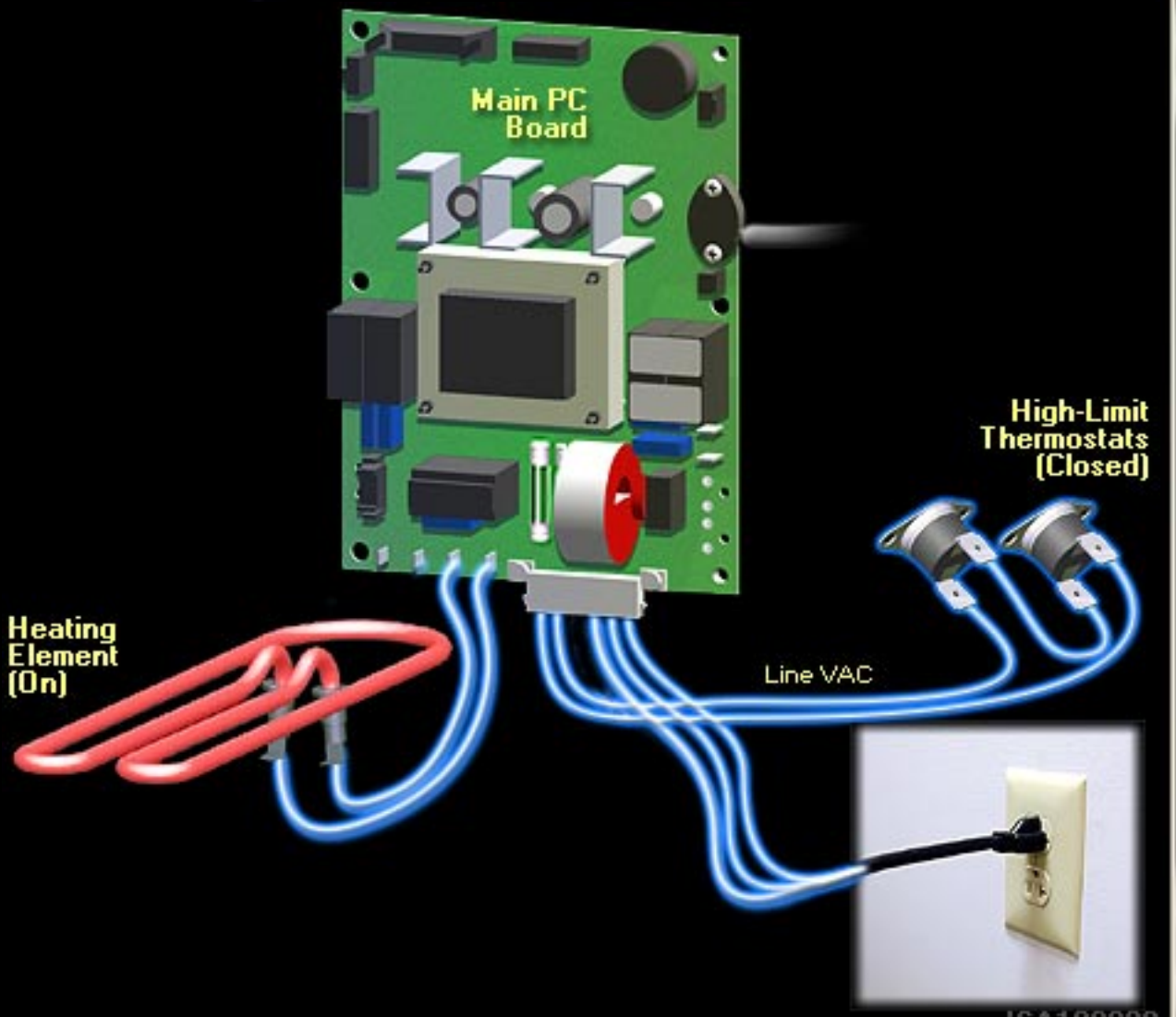
The display shows the time and temperature parameters for the selected cycle. The duration of the Dry Mode is also shown.

FAST VENT indicates that the vent valve will remain open until the chamber is completely vented.

Press the START button to initiate the Fill Mode.

MIDMARK

Pre-Heat Mode



During the Pre-Heat Mode, the PC Board supplies voltage to the two High Limit Thermostats.

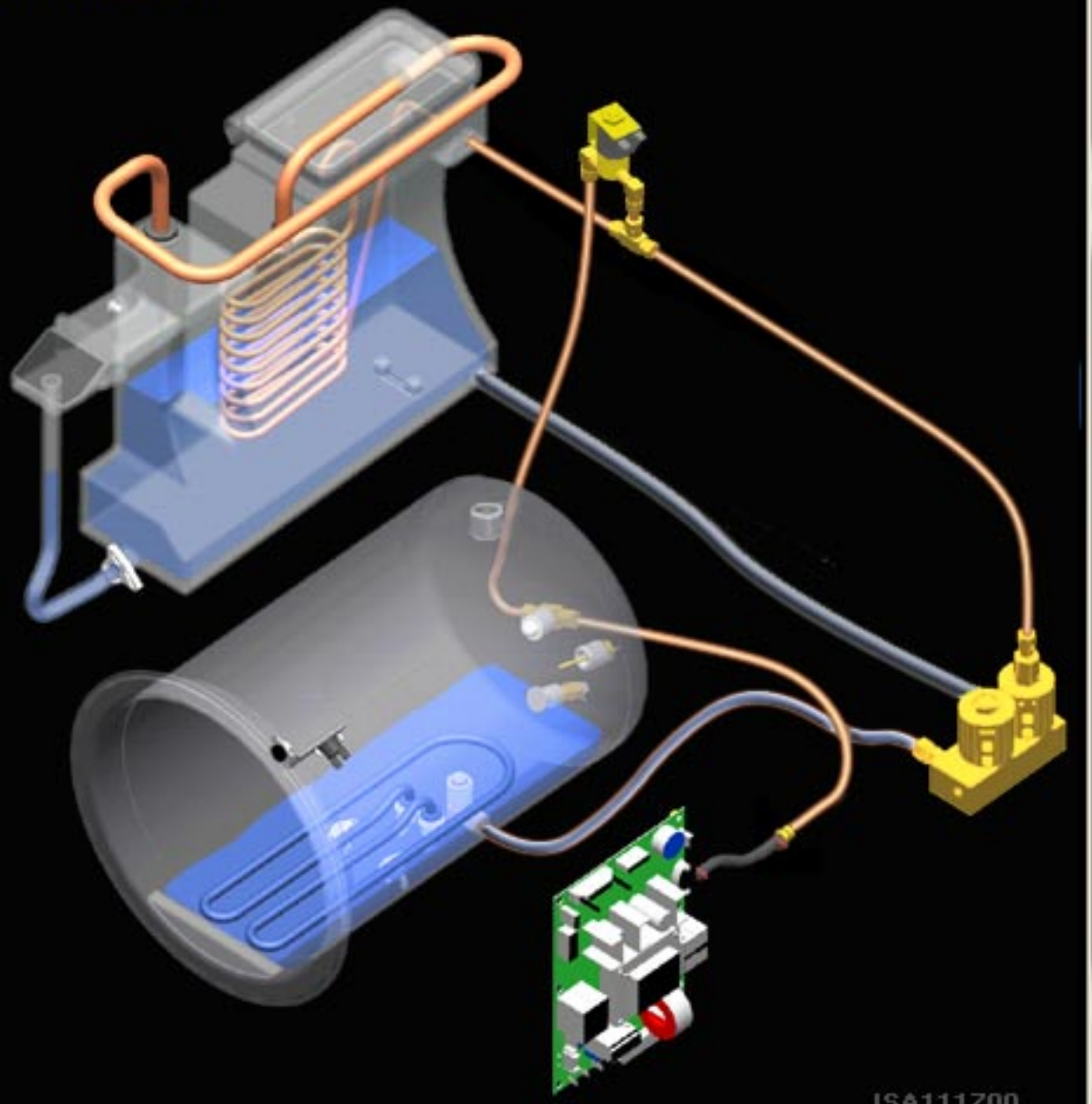
Current passes through the normally closed contacts of the thermostats, back to the PC board.

The Heating Element is energized ON and OFF at pre-set intervals. This continues for 10 minutes, or until a cycle is initiated.

To initiate the demonstration cycle:
Press the UNWRAPPED button

MIDMARK

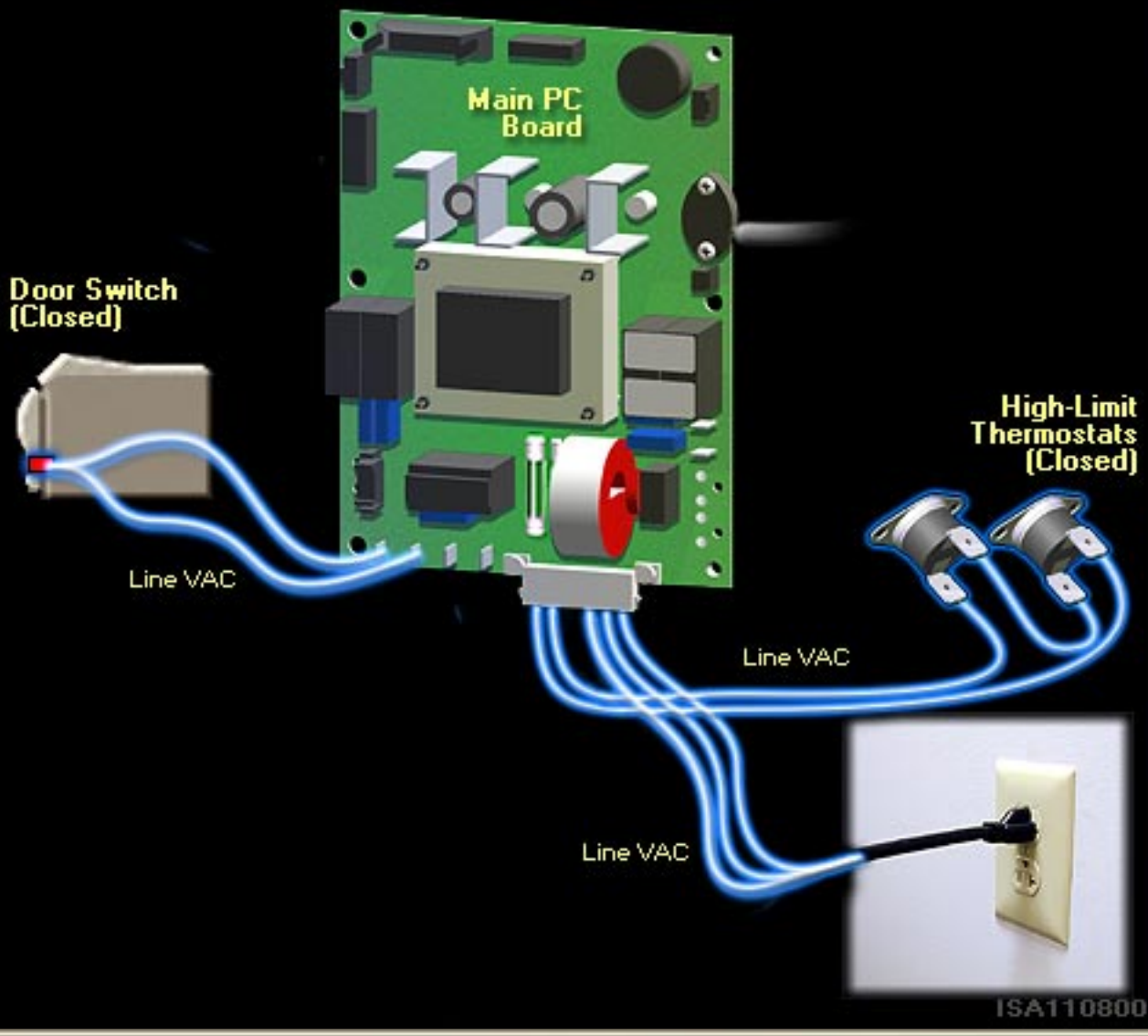
Fill Mode



During the Fill Mode, water flows from the reservoir, through the Fill Valve into the Pressure Vessel.

MIDMARK

Fill Mode

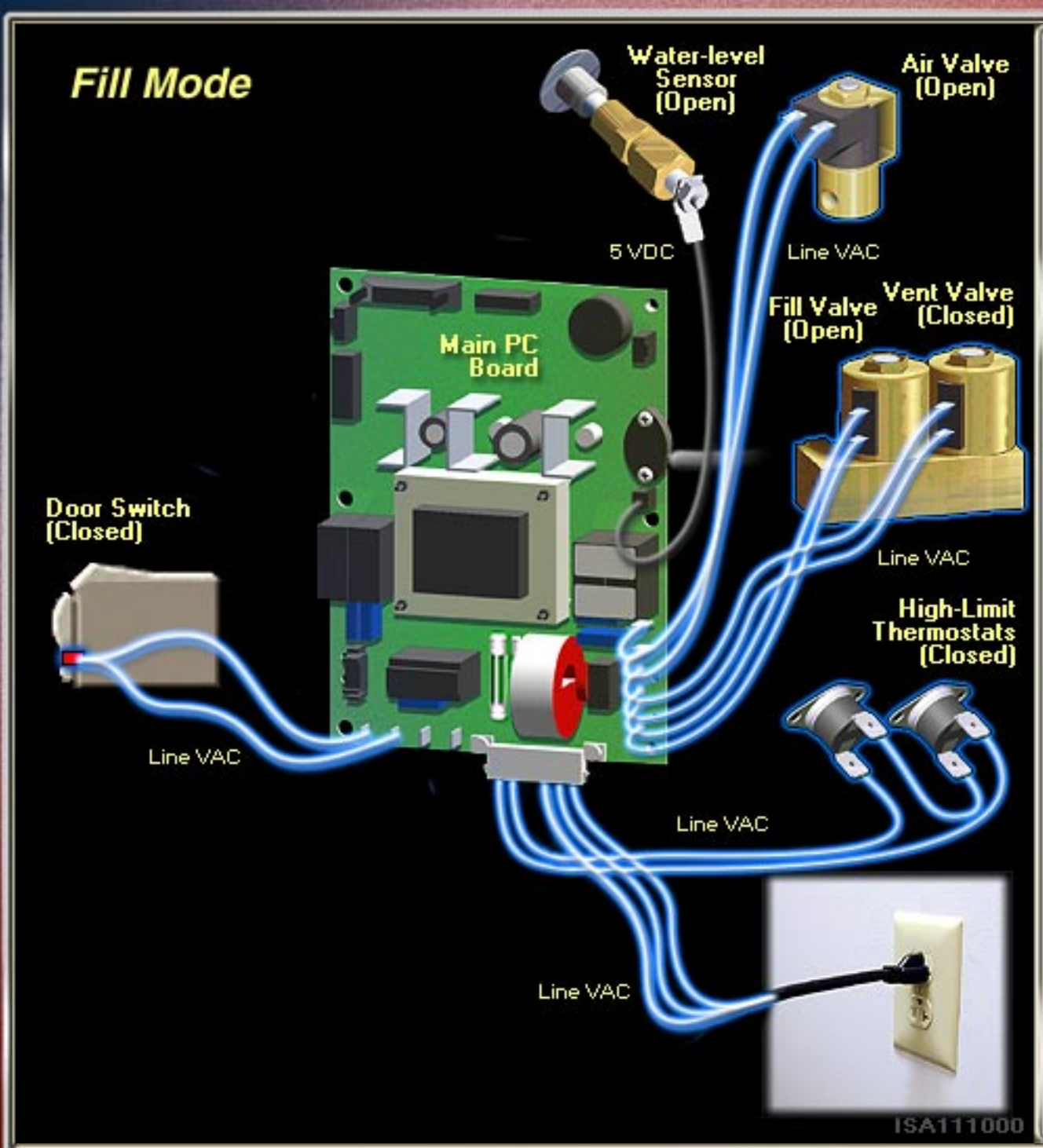


Throughout the entire cycle, current flows through the normally closed contacts of the two High-Limit Thermostats. This circuit powers all of the line voltage components, except for the Fan.

The PC Board continuously monitors the Door Switch. If the door is open, the cycle will not start. If the door is opened during a cycle, the cycle will be terminated.

If the Door Switch is closed, the Fill Mode will be initiated.

MIDMARK



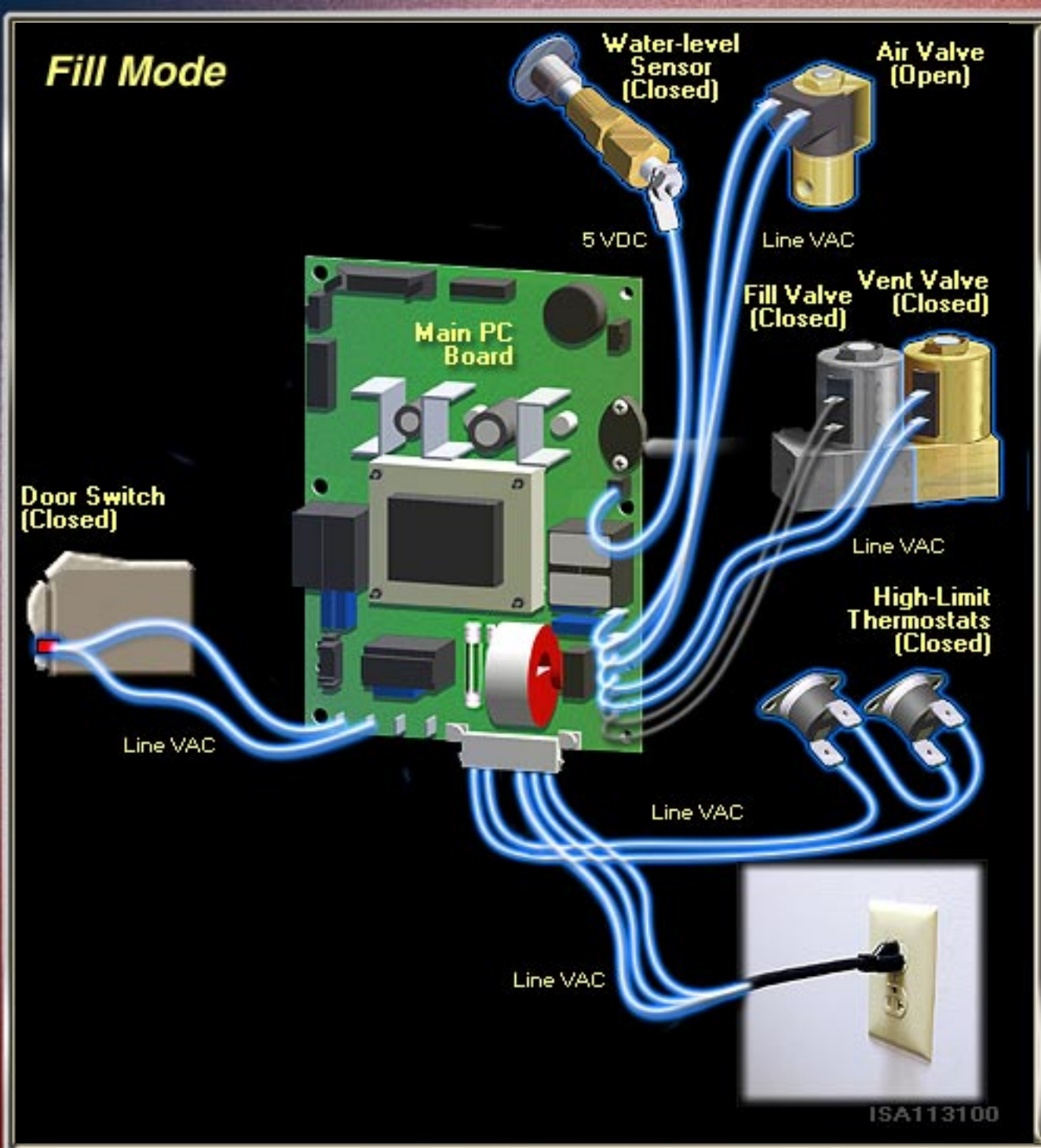
During the Fill Mode, the PC Board energizes the following components:

Air Valve - Open
Vent Valve - Closed
Fill Valve - Open

When the Fill Valve is open, water flows into the chamber.

The Fill Valve remains open *(energized)* until the water level inside the chamber reaches the Water Level Sensor.

MIDMARK



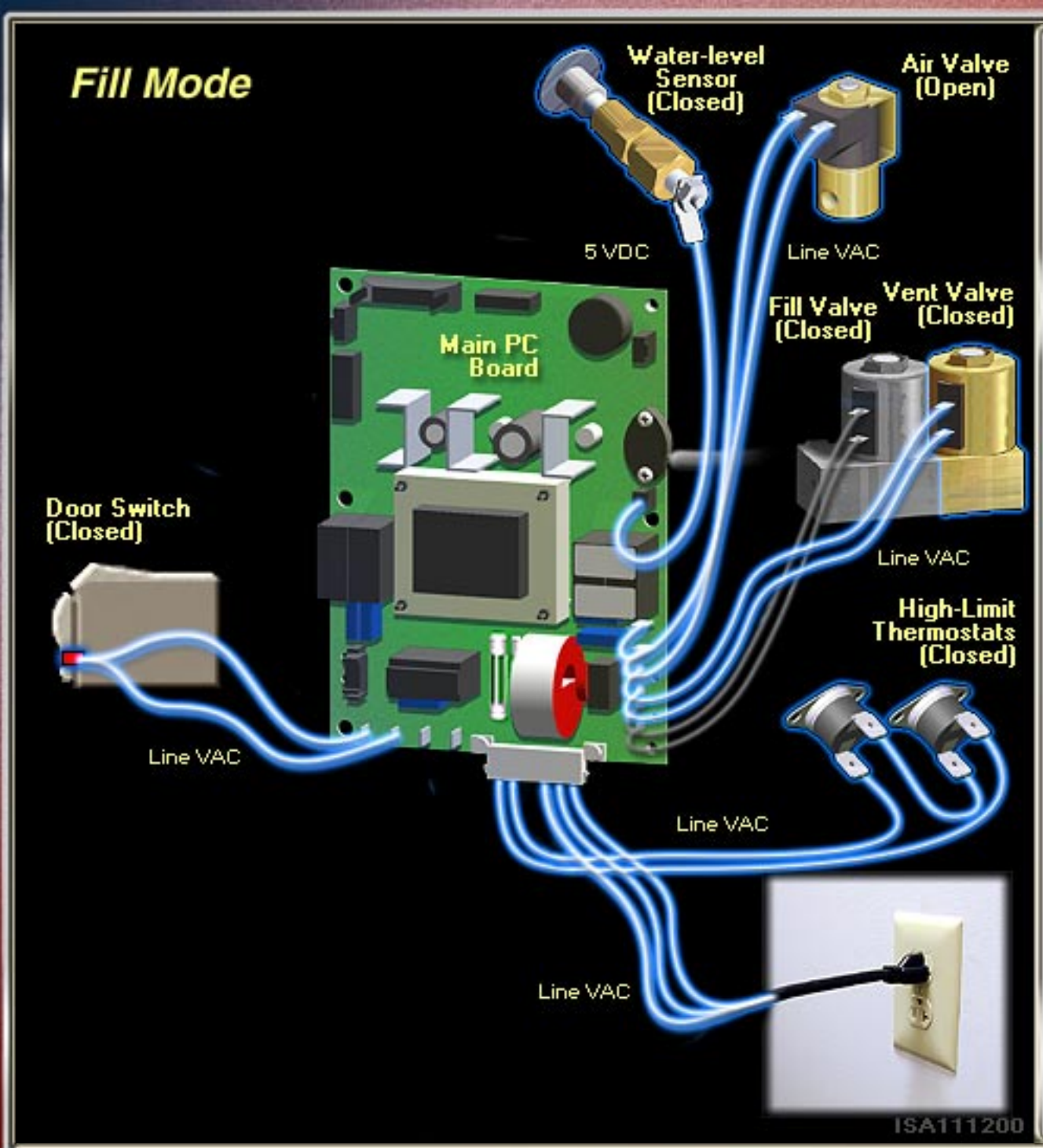
Air Valve - Open
Vent Valve - Closed

When water reaches the Water Level Sensor, a circuit is completed and current flows back to the PC Board.

When voltage from the Water Level Sensor is detected, the PC Board stops the current flow to the Fill Valve. This closes the valve, stopping the flow of water into the chamber.

MIDMARK

Fill Mode

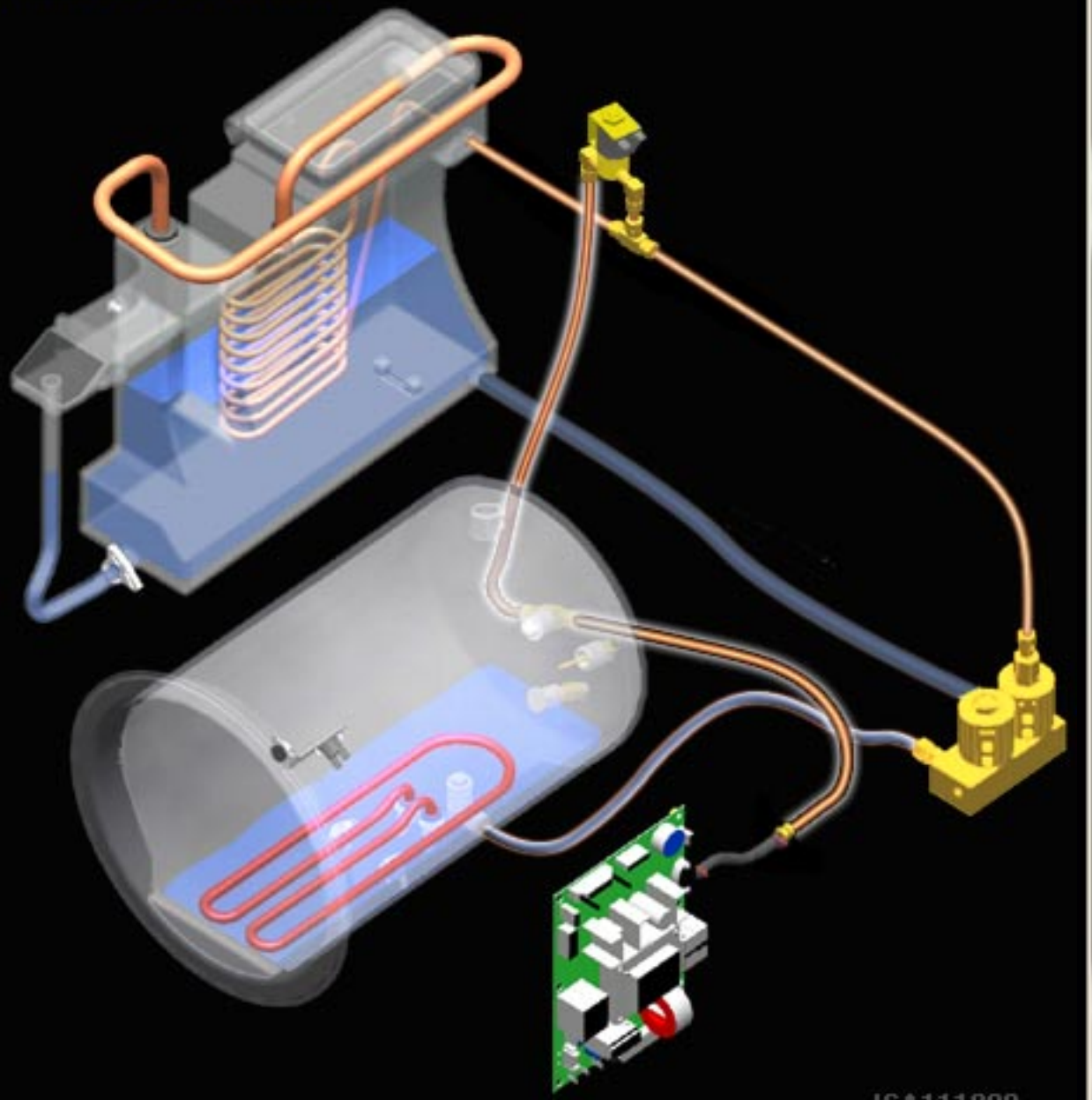


When the Fill Valve closes, the display will show CHAMBER FULL.

Fill Mode is complete.
Next: Heat-Up Mode

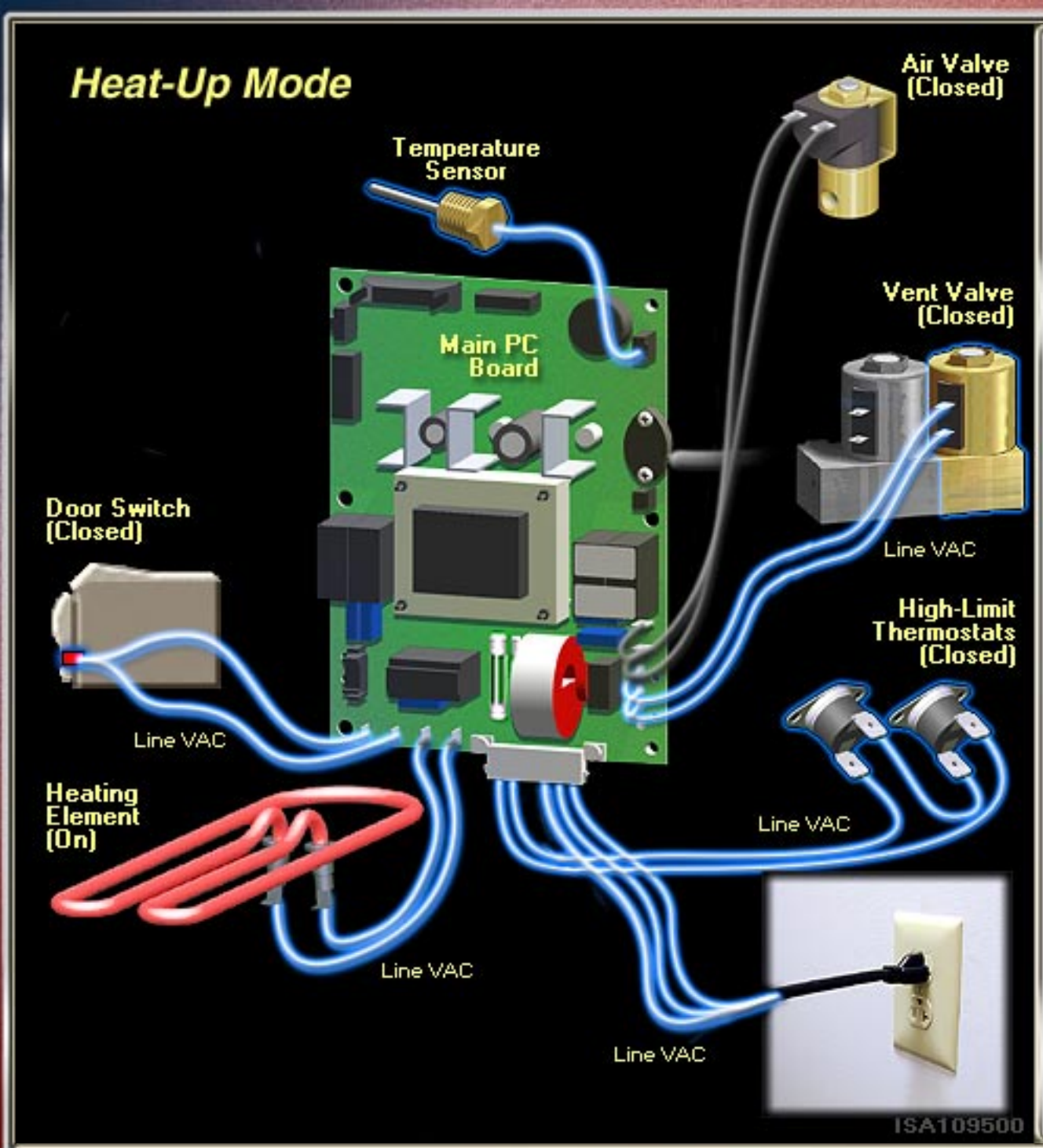
MIDMARK

Heat-Up Mode



During the Heat-Up Mode, the temperature and pressure increase to meet the pre-set Sterilization conditions.

MIDMARK

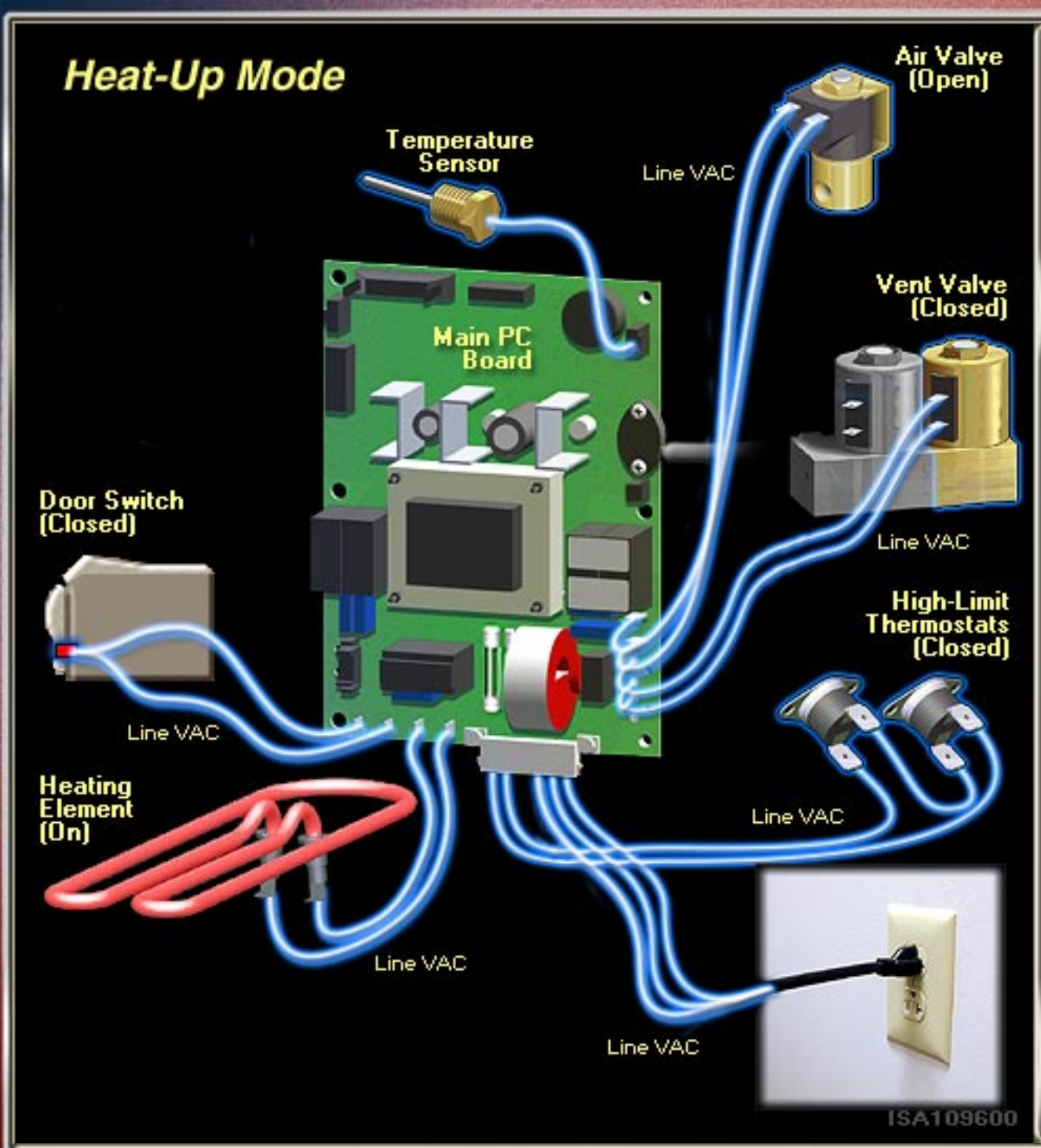


During the Heat-Up Mode, current flows through the two High-Limit Thermostats to energize the following components:

Heating Element - ON
Vent Valve - Closed

The pressure transducer on the PC Board and the Temperature Sensor monitor the conditions inside the chamber as the temperature and pressure rise.

MIDMARK

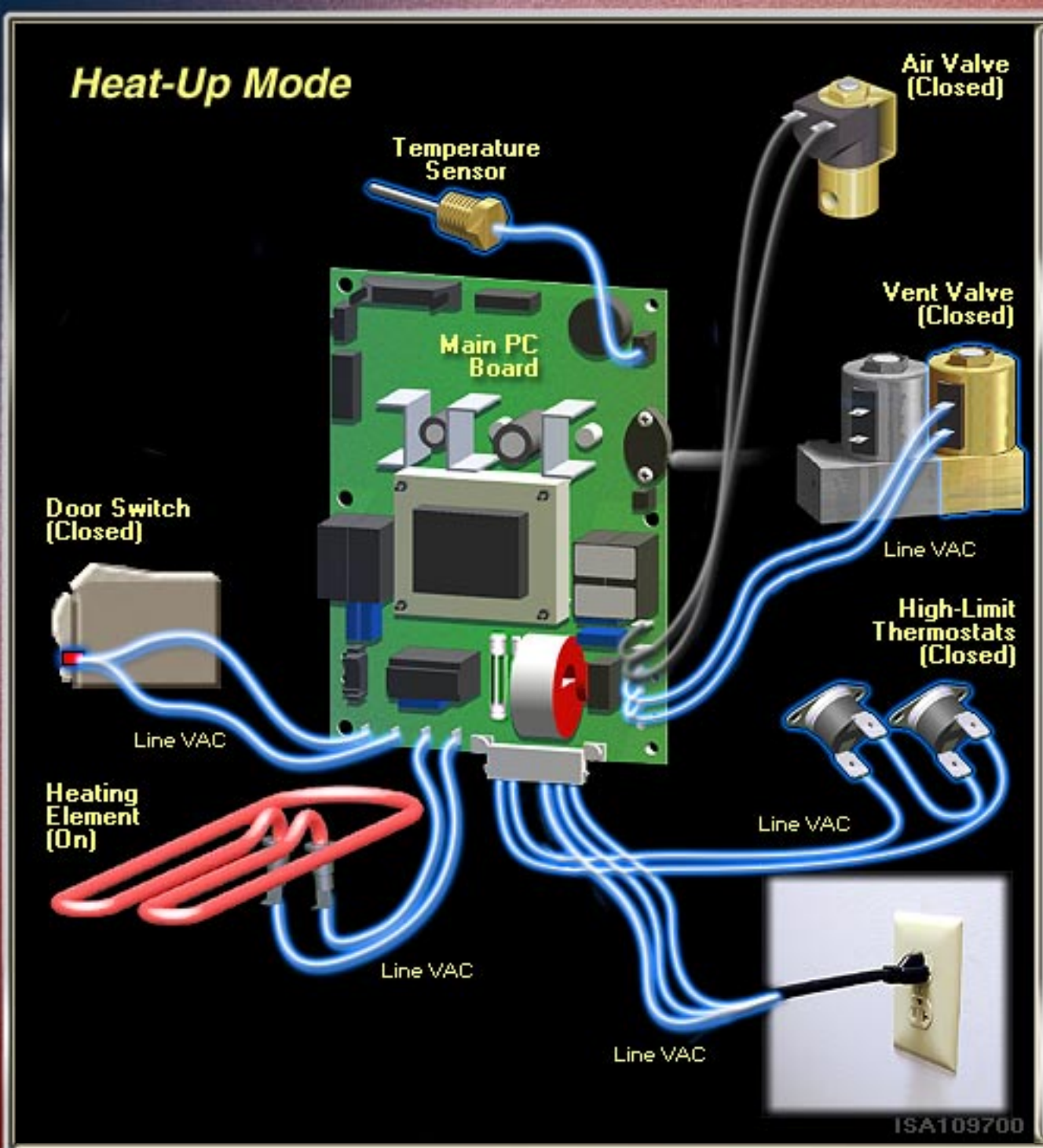


Heating Element - ON
Vent Valve - Closed

When the pressure reaches one-half of the pre-set sterilization pressure, the Air Valve is energized (Open) for approximately 50 seconds.

This occurs three times during the Heat-Up mode to expel air from the chamber.

MIDMARK



Heating Element - ON
Vent Valve - Closed

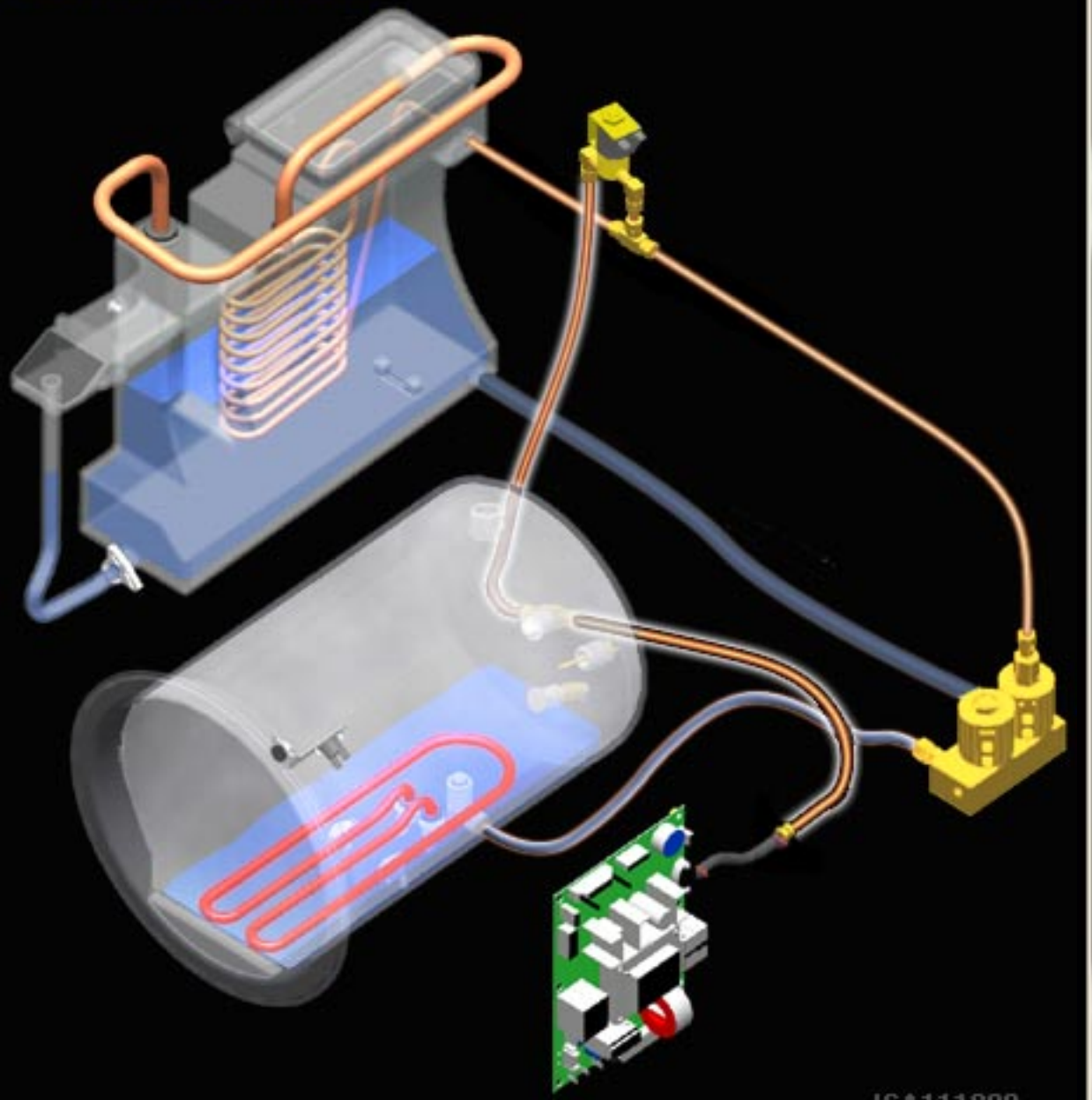
After the excess air has been expelled from the chamber, the Air Valve closes.

The chamber temperature and pressure rise until the pre-set Sterilization conditions are met.

Heat-Up Mode is complete.
Next: Sterilizing Mode

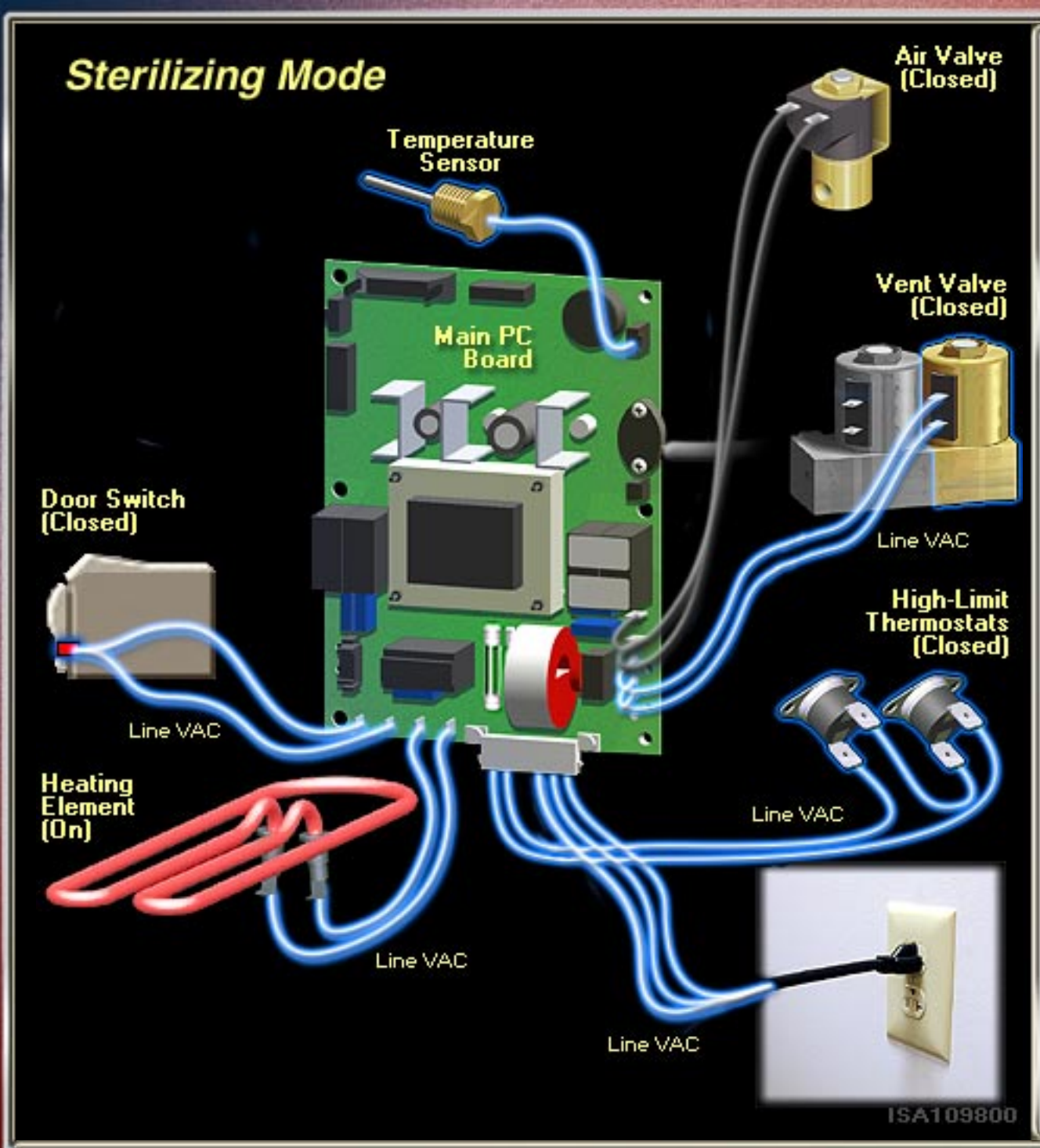
MIDMARK

Sterilizing Mode



During the Sterilizing Mode, the temperature and pressure parameters for the selected cycle are maintained for the required time.

MIDMARK



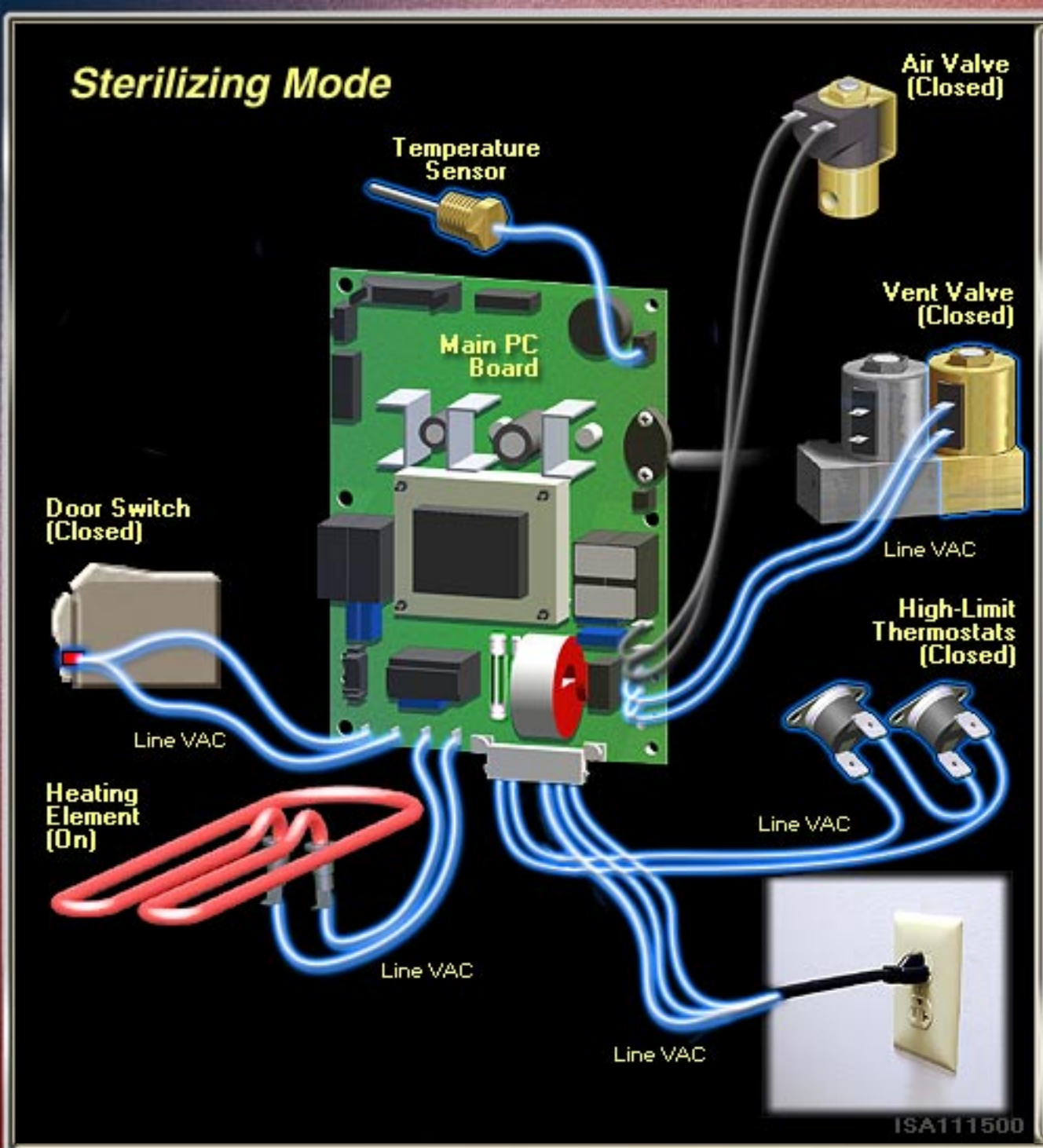
During the Sterilizing Mode, current flows through the two High-Limit Thermostats to energize the following components:

Vent Valve - Closed
Heating Element - ON / OFF / ON

The Heating Element is cycled ON and OFF to maintain the required temperature and pressure.

MIDMARK

Sterilizing Mode



Count Down

Vent Valve - Closed
Heating Element - ON / OFF / ON

The sterilization time counts down on the display screen.

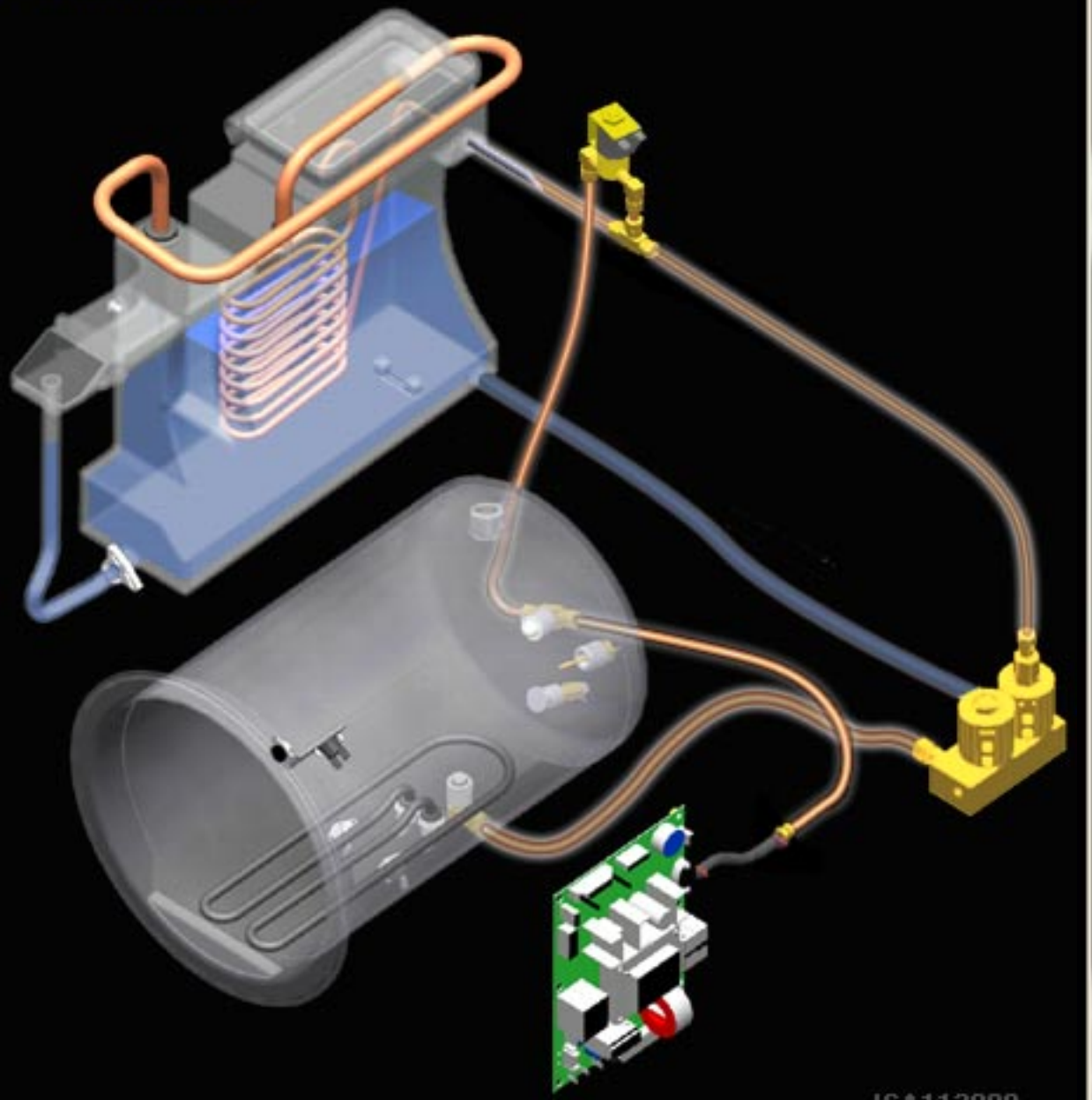
The pressure transducer on the PC Board and the Temperature Sensor monitor the internal chamber conditions.

During the final 10 seconds of the Sterilizing Mode, "READY TO VENT" flashes on and off in the display.

Sterilizing Mode is complete.
Next: Vent Mode

MIDMARK

Vent Mode

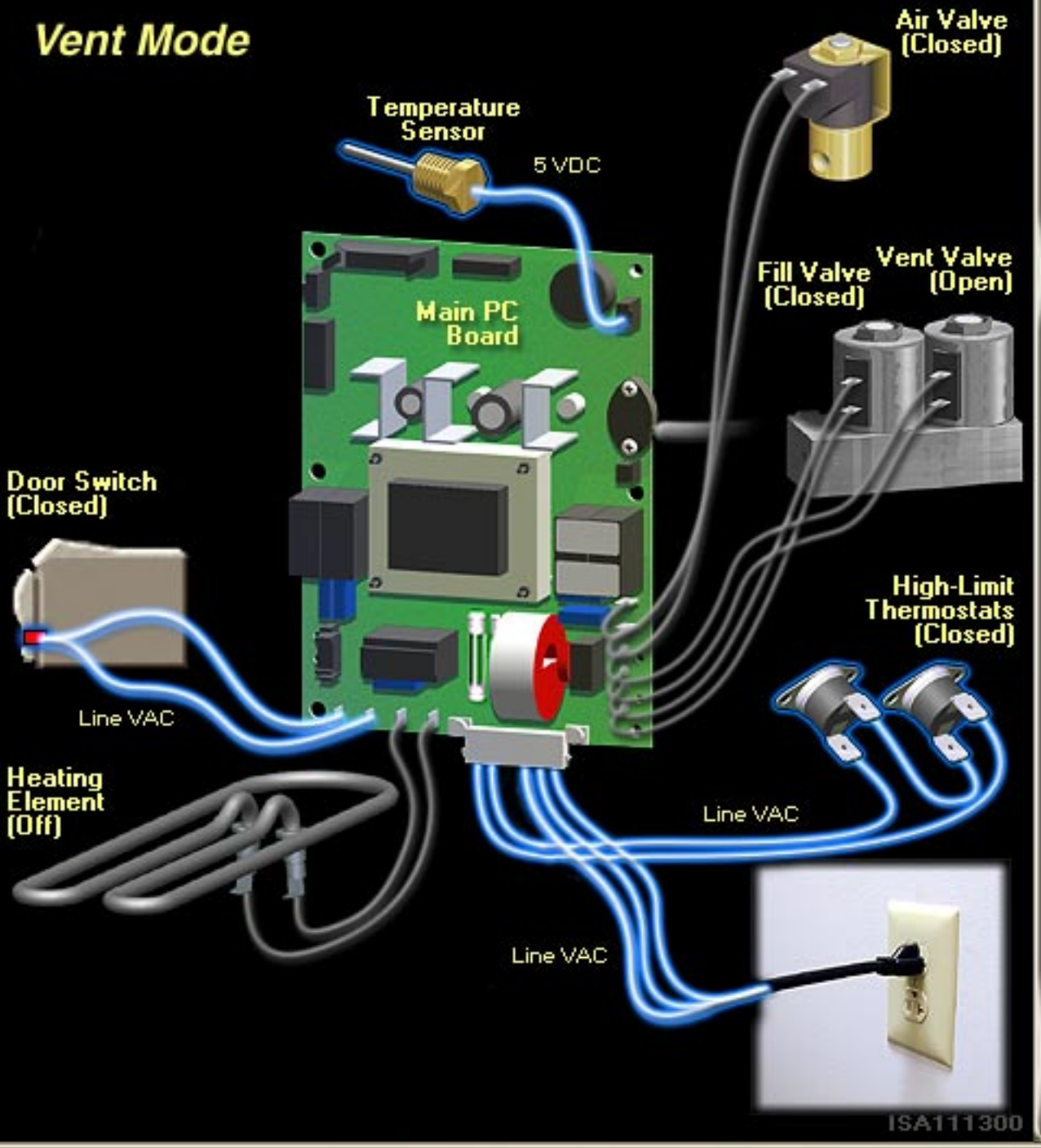


During the Vent Mode, the Vent Valve opens to release pressure from the chamber.

The steam cools as it passes through the condensing coil, and the water is returned to the reservoir.

MIDMARK

Vent Mode



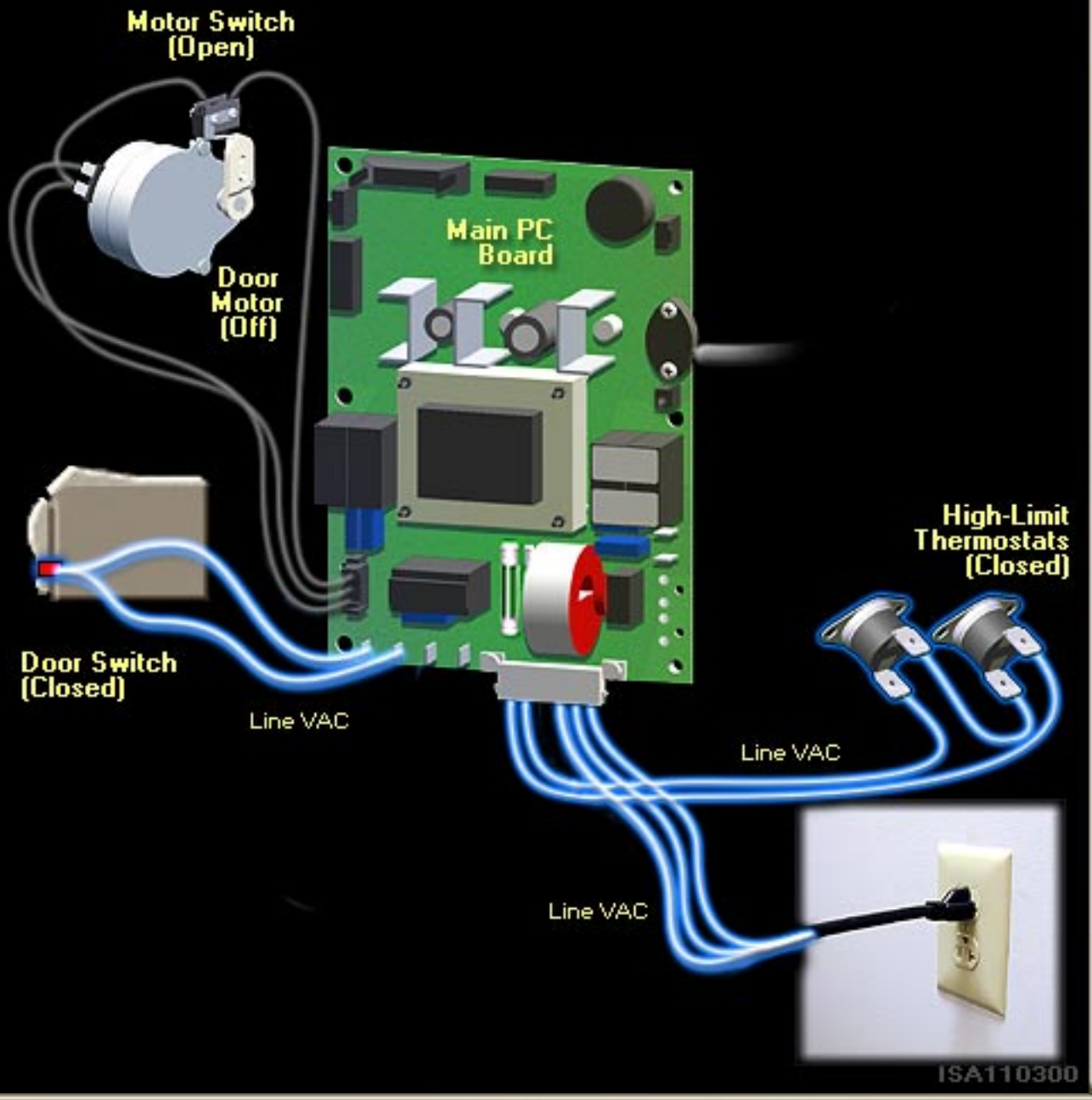
During the Vent Mode, the PC Board stops the current flow to the Vent Valve. This opens the valve, and the pressure is released from the chamber.

The steam from the chamber is vented through the condensing coil located in the reservoir.

Vent Mode is complete.
Next: Door Motor System

MIDMARK

Door Motor System (M9 & M11 only)



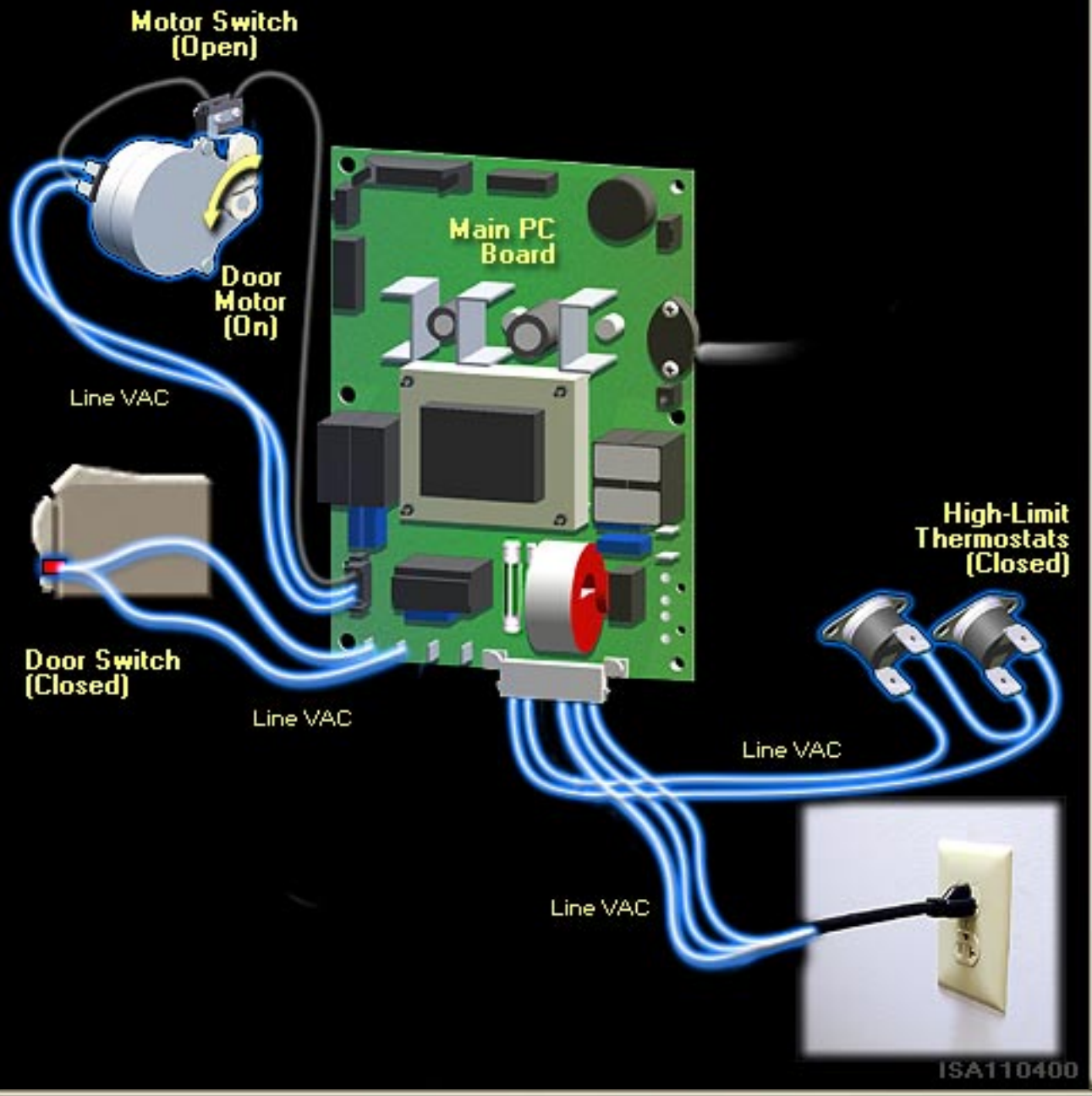
NOTE

The voltage to power the Door Motor System is supplied through the two High-Limit Thermostats.

When the pressure in the chamber reaches 0.7 psi (5 kPa), the PC Board sounds several audible beeps. This indicates the door will open in approximately five seconds.

MIDMARK

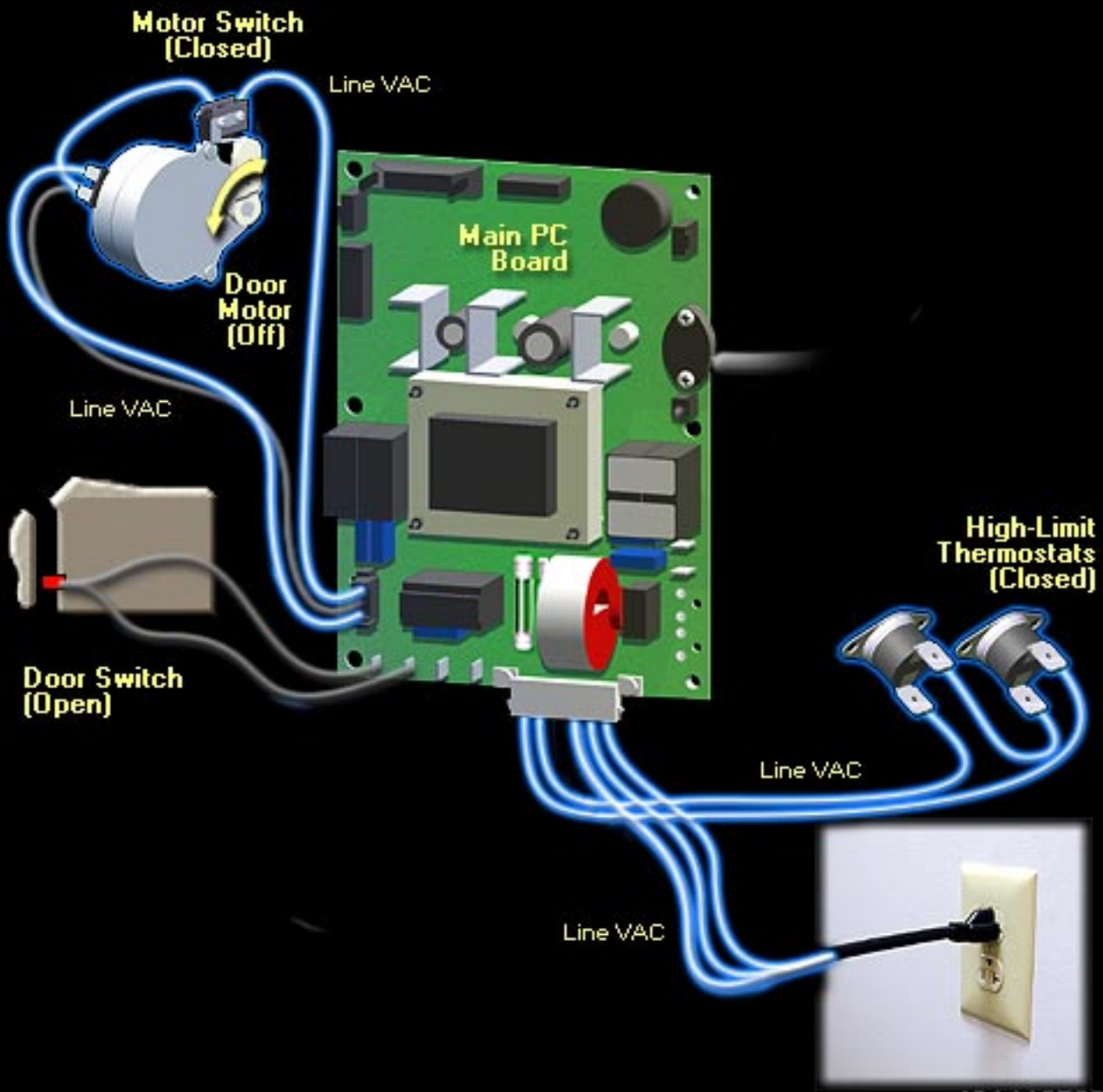
Door Motor System (M9 & M11 only)



The PC Board bypasses the Motor Switch and supplies voltage directly to the Door Motor for 15 seconds. This causes the Door Motor to run.

MIDMARK

Door Motor System (M9 & M11 only)



The PC Board bypasses the Motor Switch and supplies voltage directly to the Door Motor for 15 seconds. This causes the Door Motor to run.

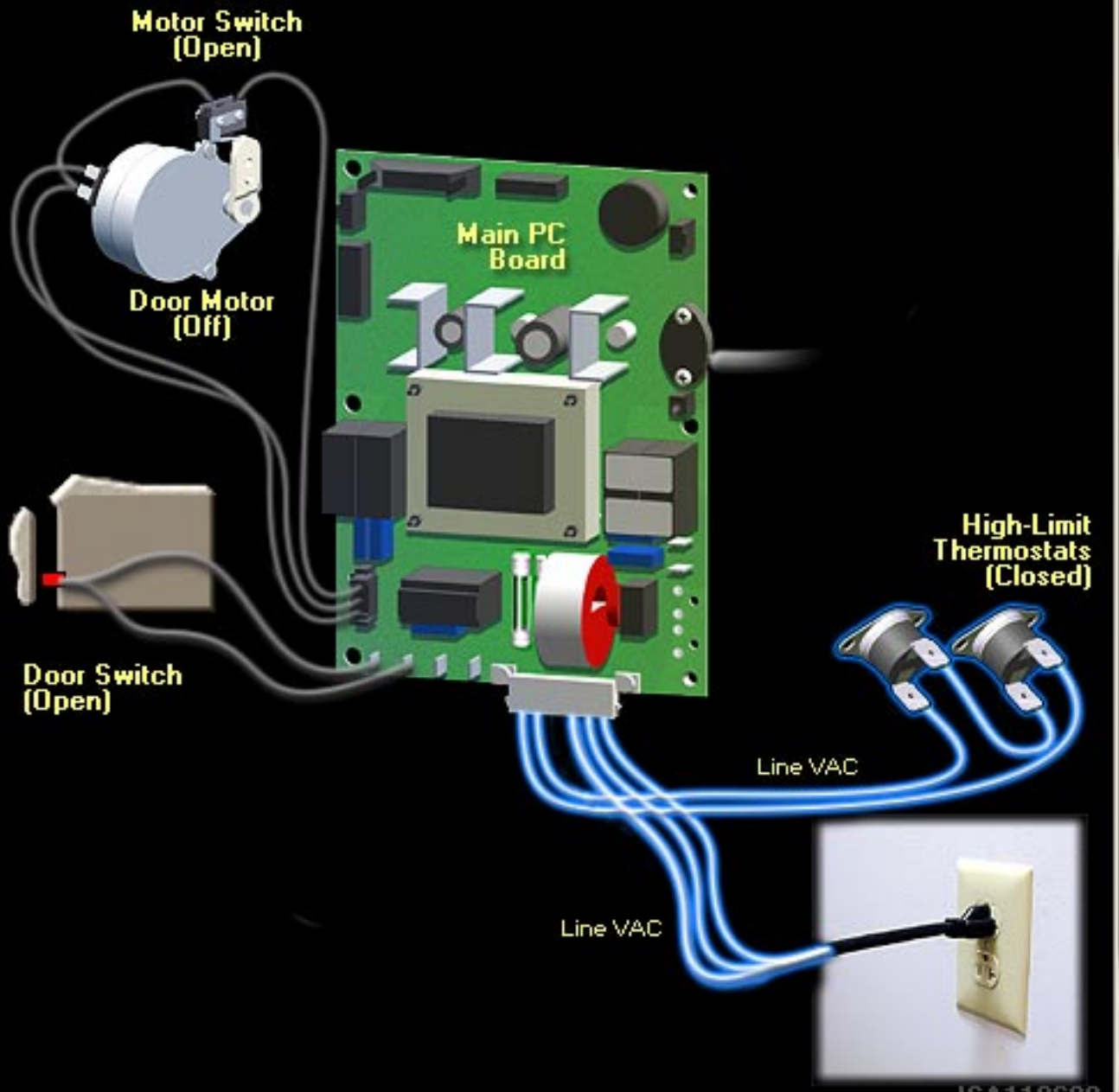
ATTENTION

As the mechanism rotates, the Motor Switch closes. After 15 seconds, the current to the Door Motor flows through the switch.

The Door Motor mechanism lifts the door latch, opening the door.

MIDMARK

Door Motor System (M9 & M11 only)



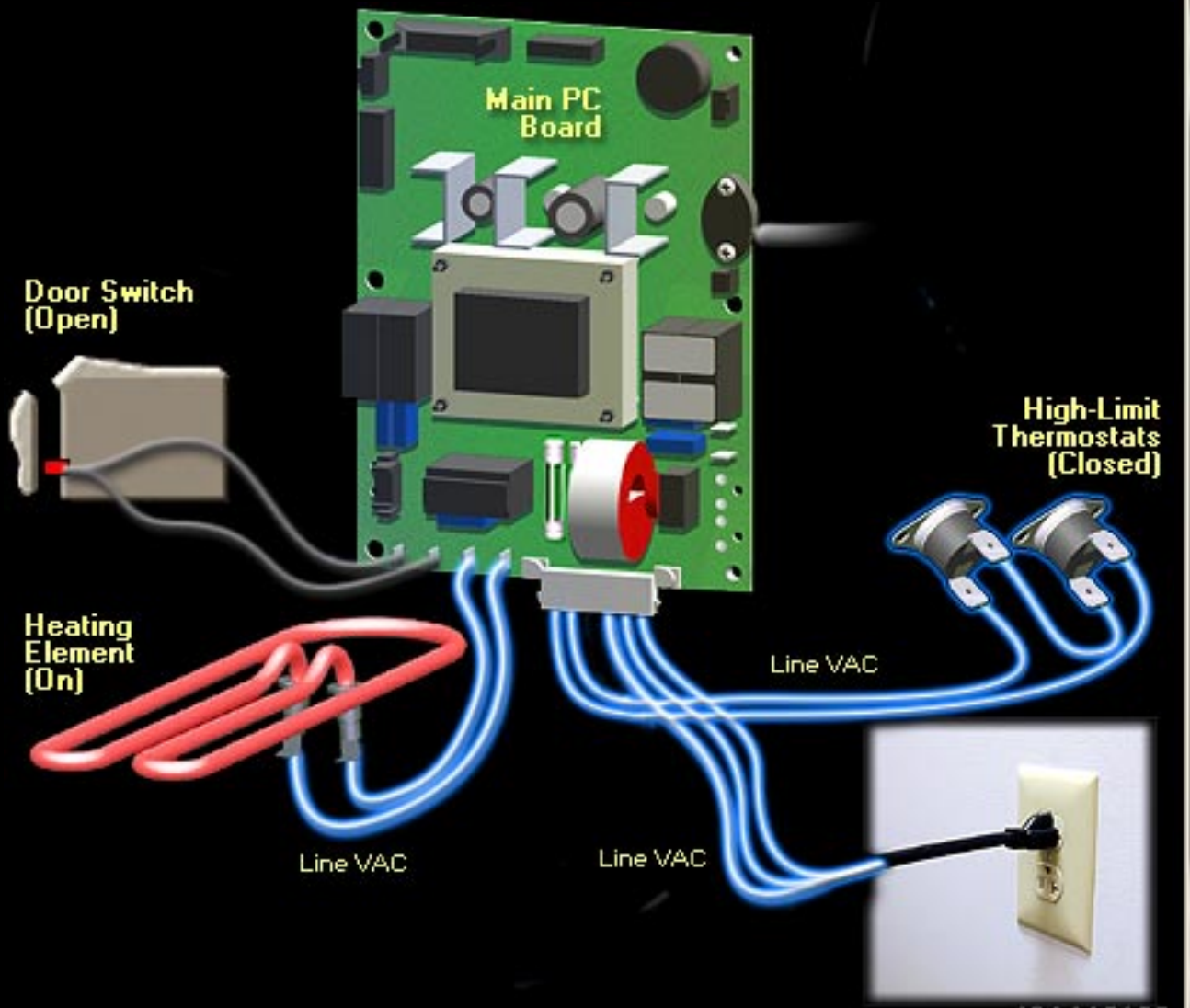
When the Door Motor mechanism reaches the bottom of its travel, the motor reverses direction.

When the mechanism reaches its original position, the Motor Switch is opened. This stops the current flow to the motor, and the motor stops.

Next: Dry Mode

MIDMARK

Drying Mode

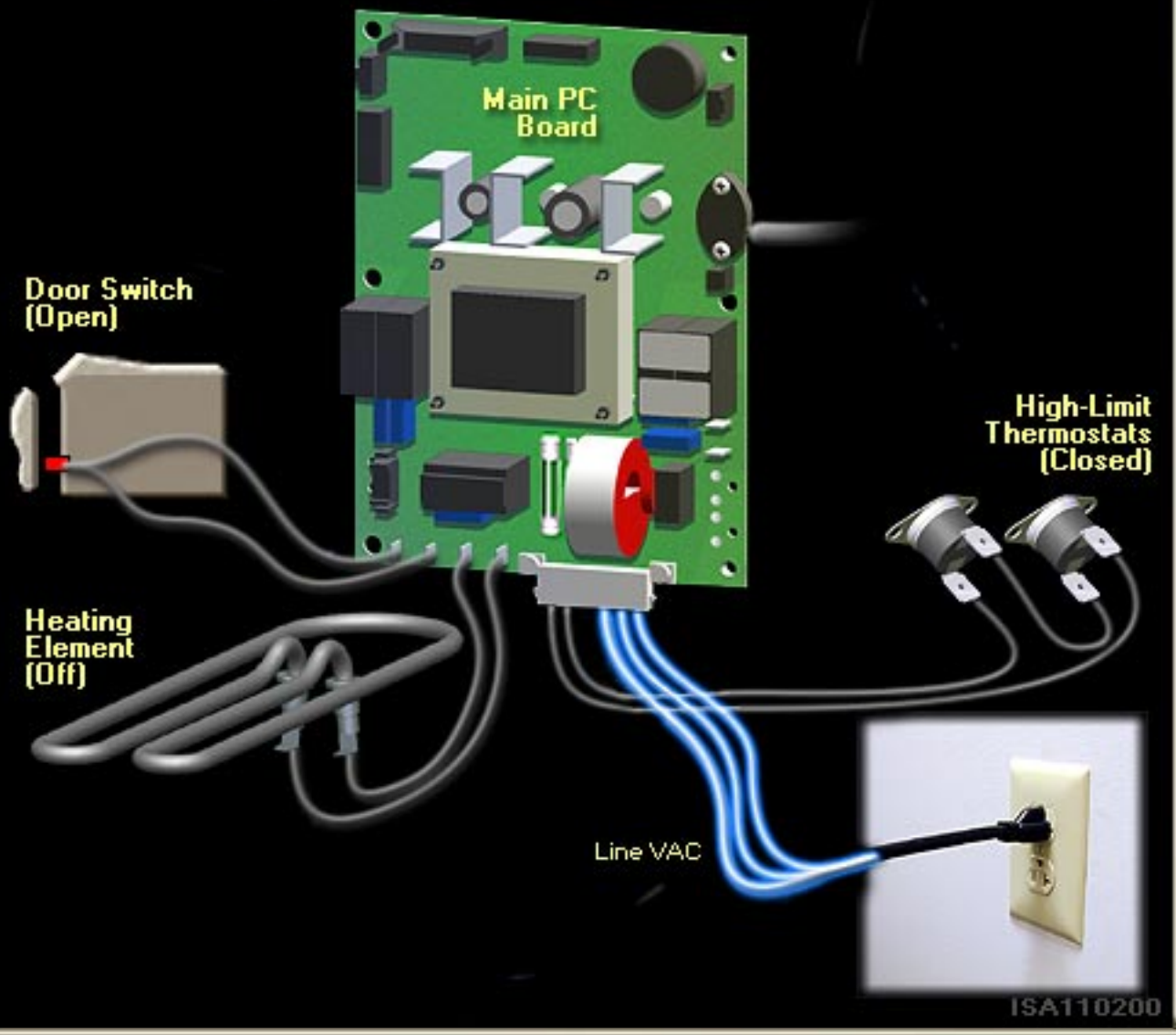


During the Dry Mode, current flows through the two High-Limit Thermostats to energize the Heating Element.

The Heating Element is energized ON and OFF at pre-set intervals. This continues for the duration of the Dry Mode.

MIDMARK

Drying Mode

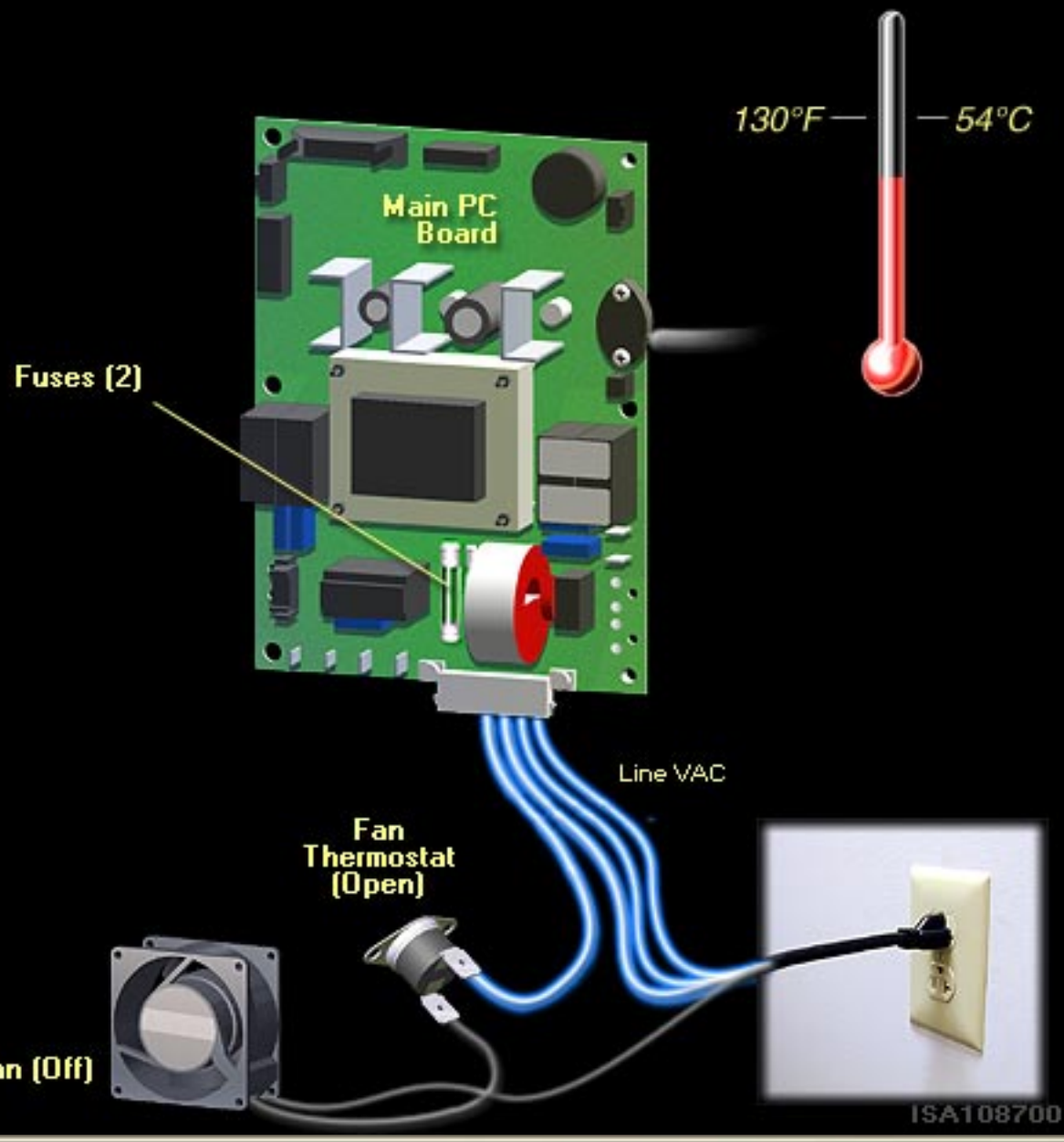


When the drying time expires, the PC Board stops the current flow to the High-Limit Thermostats and the Heating Element.

Dry Mode is complete.
Next: Fan System

MIDMARK

Fan System



Whenever the unit is plugged in, voltage is supplied through the two primary Fuses directly to the Fan Thermostat.

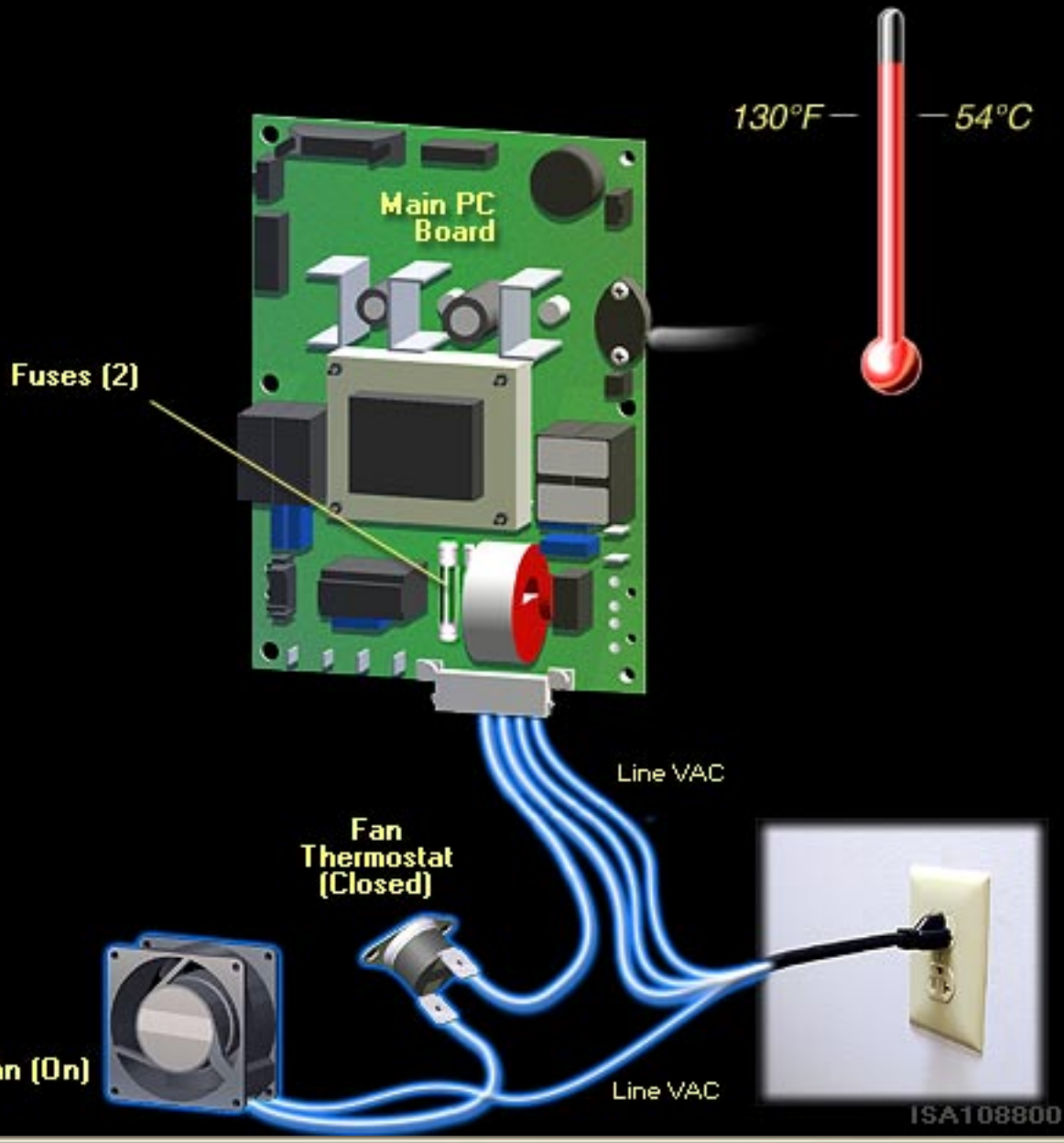
The contacts of the Fan Thermostat are open until the temperature *(at the thermostat)* reaches 130°F (54°C).

ATTENTION

The Fan may operate continuously when running consecutive cycles.

MIDMARK

Fan System



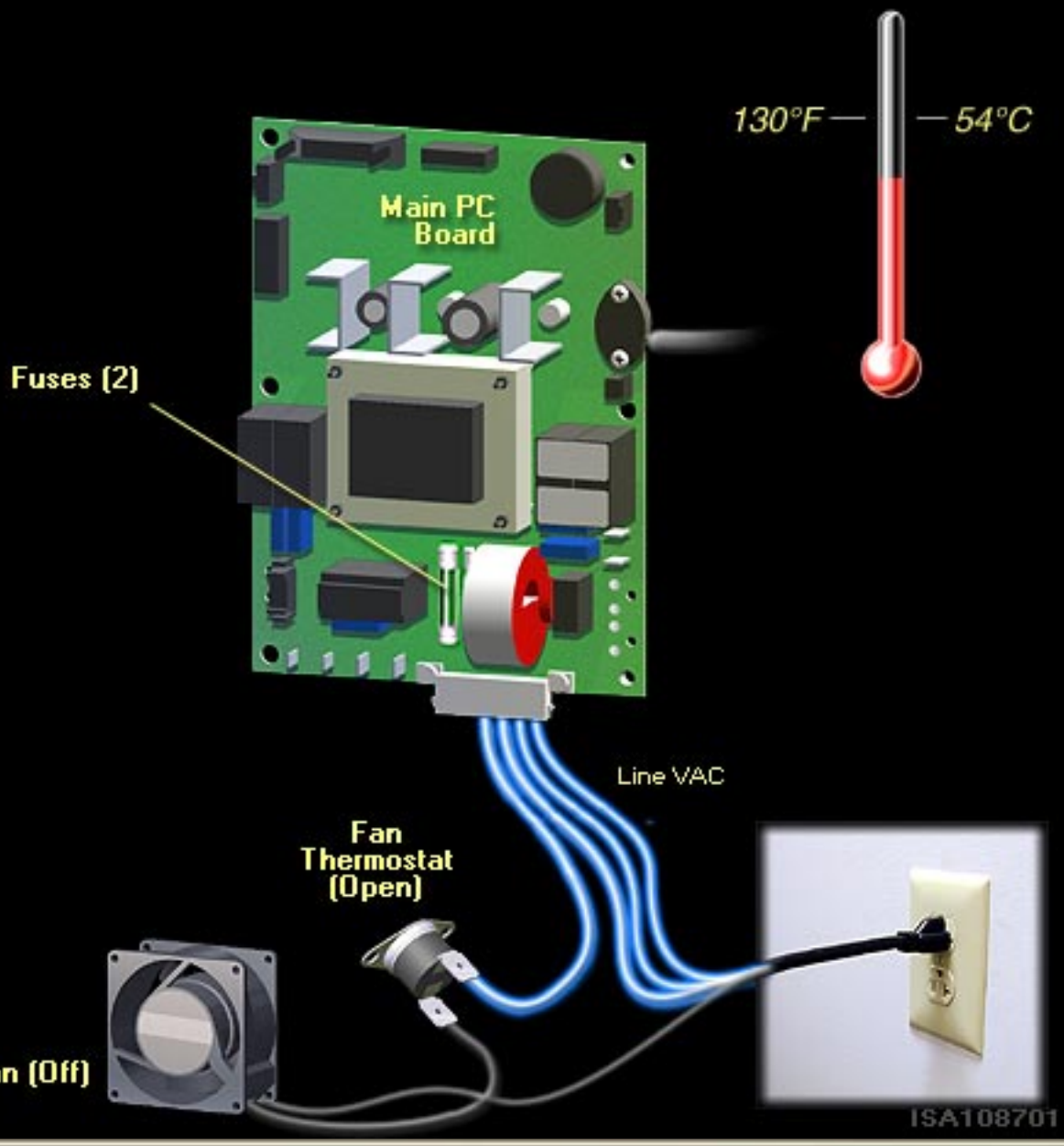
ATTENTION

The Fan may operate continuously when running consecutive cycles.

When the temperature reaches 130°F (54°C), the Fan Thermostat contacts close. This allows current to flow to the Fan, causing the Fan to run.

MIDMARK

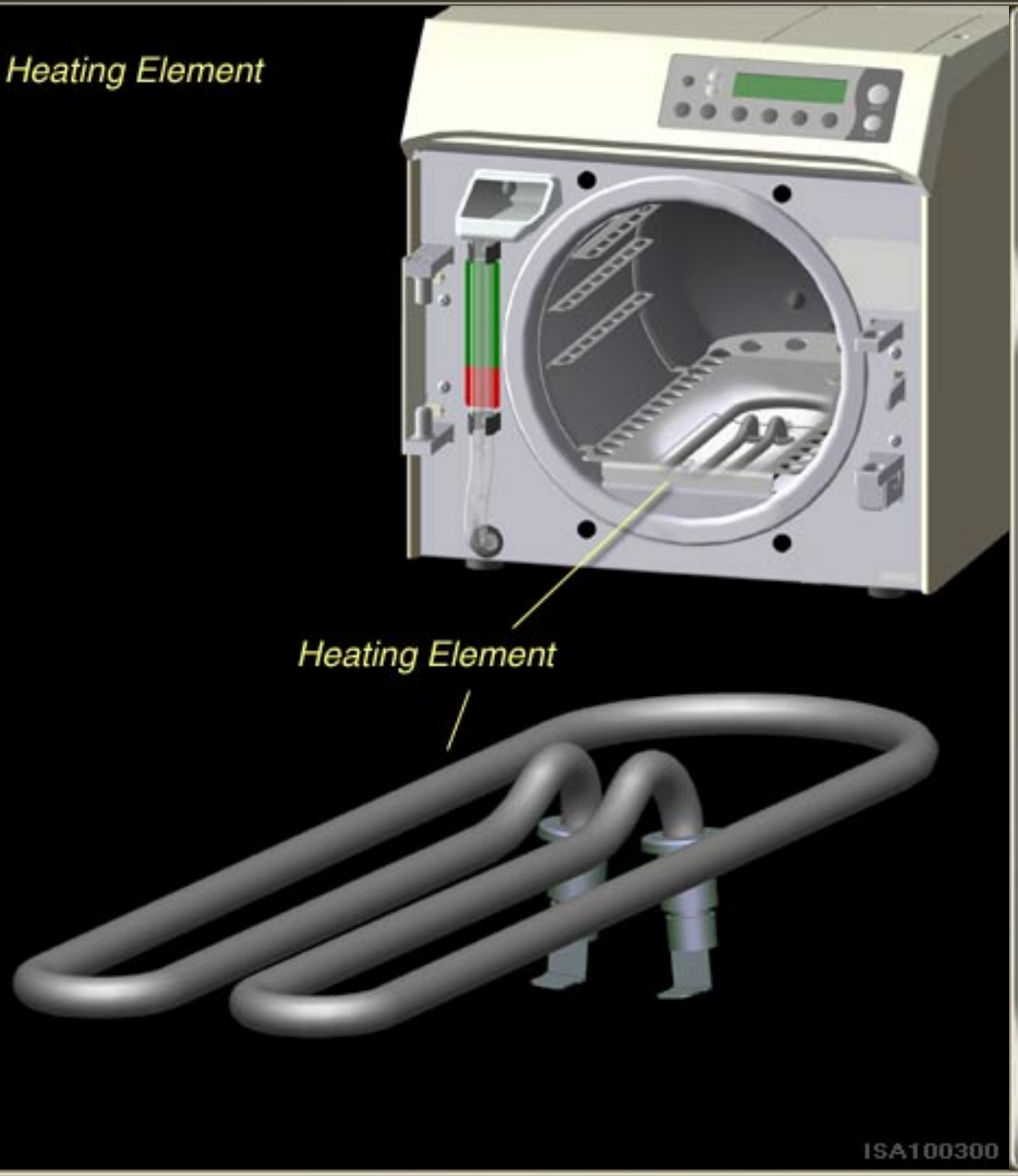
Fan System



When the temperature drops to approximately 100°F (38°C), the Fan Thermostat contacts open and the Fan stops running.

Theory of Operation is complete. Select desired button to continue.

MIDMARK

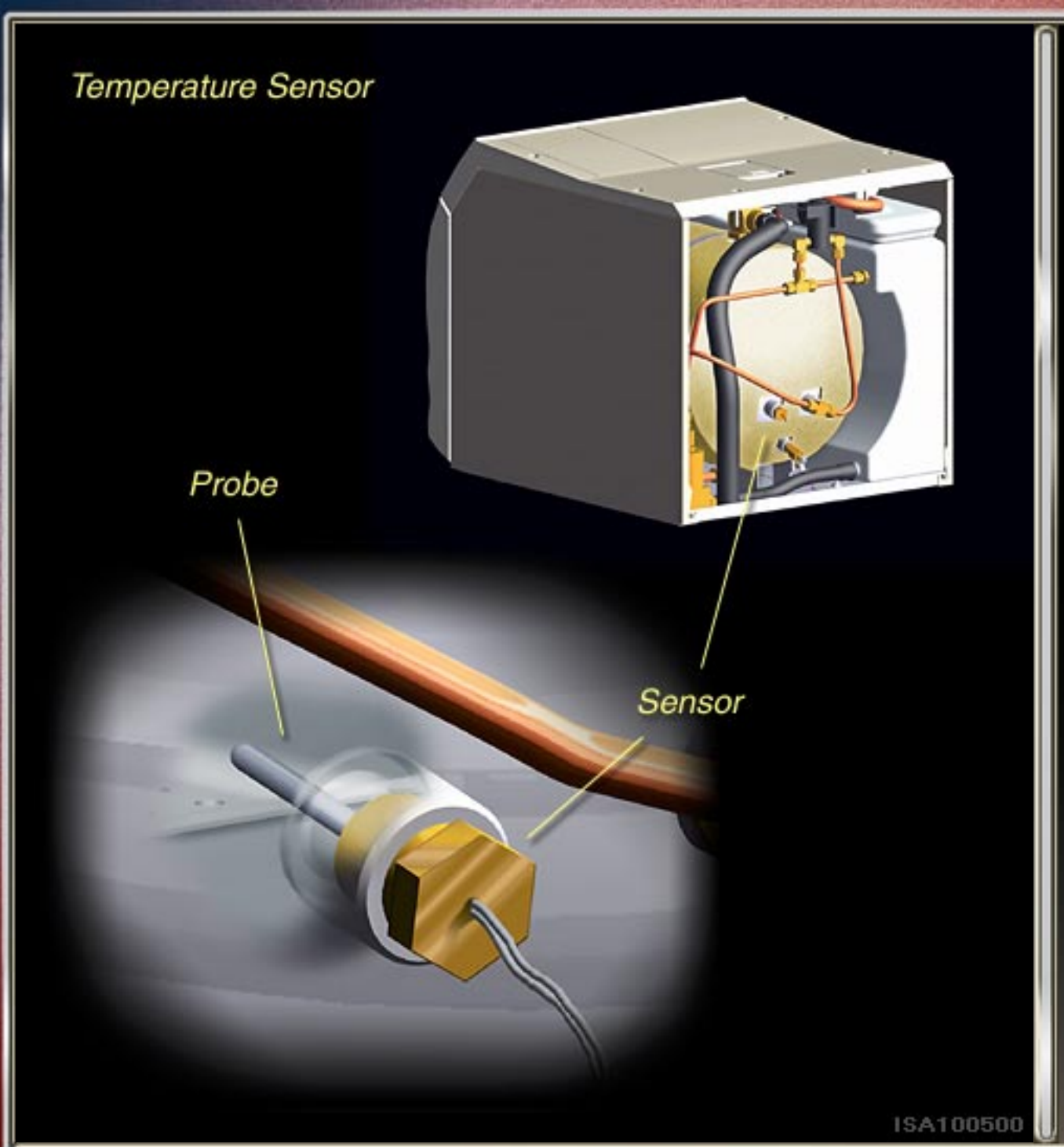


The submersible Heating Element is located inside the pressure vessel, under the tray plate.

During the Heat-Up, Sterilization, and Dry Modes, the PC board turns the Heating Element ON and OFF to reach and maintain proper chamber conditions.

[Refer to the Components section for resistance test procedure]

MIDMARK



The Temperature Sensor is located in the back of the pressure vessel.

During the Heat-Up and Sterilization Modes, this sensor monitors the chamber temperature and transmits this information to the PC board.

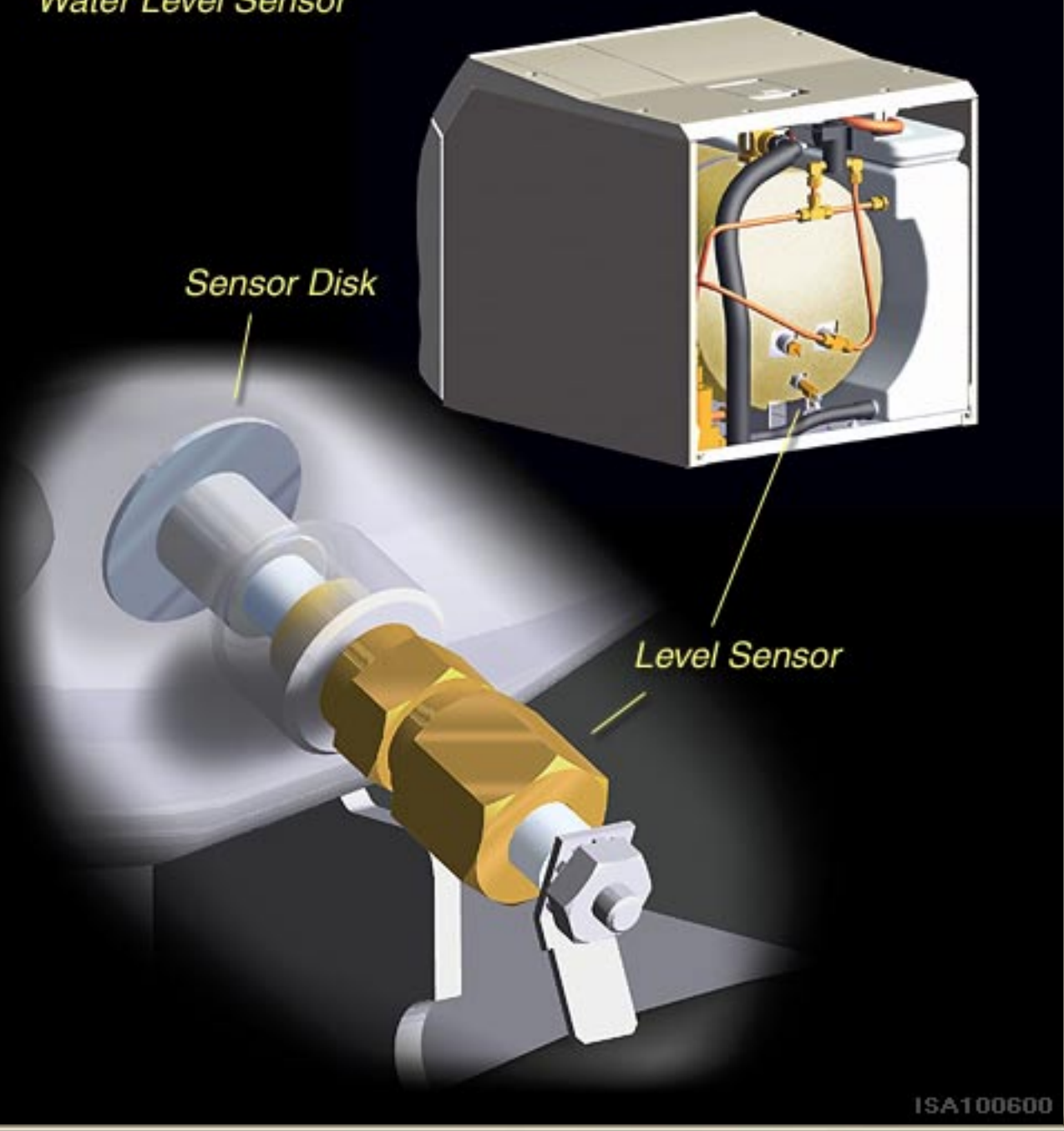
The PC board turns the heating element ON and OFF based on the readings from the Temperature Sensor.

Service Tip

Residue can build-up on the Probe of the sensor causing inaccurate temperature readings. If a temperature related malfunction occurs, clean the Probe with SpeedClean and an abrasive pad.

[Refer to the Components section for resistance test procedure]

MIDMARK



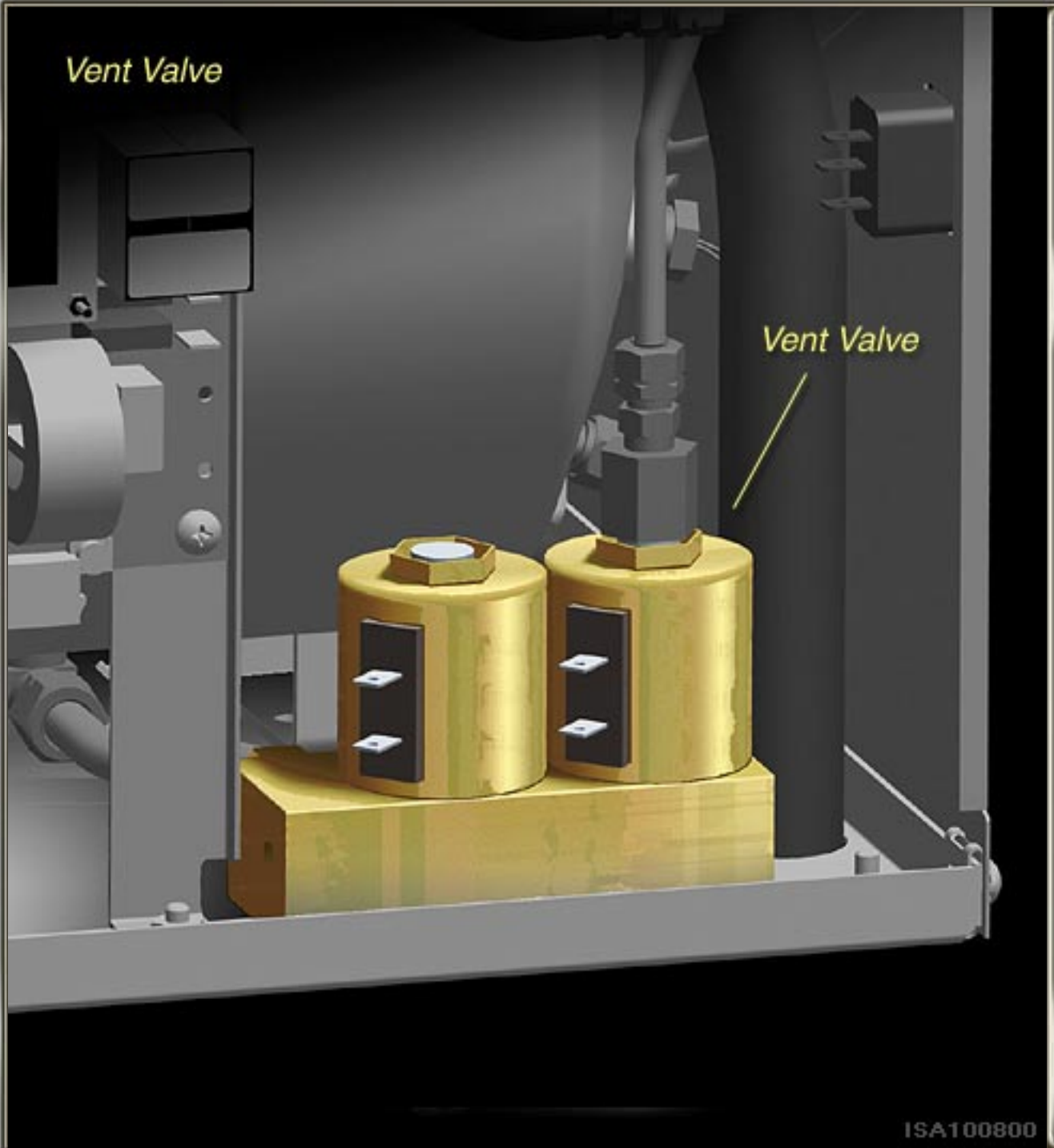
The Water Level Sensor is located in the back of the pressure vessel.

This sensor monitors the water entering the pressure vessel during the Fill Mode. When the water level reaches the Sensor Disk, a circuit is completed and current flows back to the PC board. When the PC board detects this voltage, the fill valve closes, stopping the flow of water into the pressure vessel .

Service Tip

Residue can build-up on the Sensor Disk, causing malfunctions during the Fill Mode. If the unit does not fill, or fills continuously, clean the Sensor Disk with SpeedClean and an abrasive pad, then dry disk thoroughly.

[Refer to the Components section for continuity test procedure]



The Vent Valve is located on the right side of the unit. This valve is open until it is energized.

During the Filling, Heat-Up, and Sterilization Modes, the PC board supplies line voltage to the Vent Valve. This closes the valve so that pressure can build in the chamber.

In the Vent Mode, the PC board stops the current flow to the Vent Valve. This opens the valve and releases the pressure from the chamber.

Service Tip

Debris flushed through the system can get trapped in the Vent Valve. This may prevent the valve from opening or closing properly. If a faulty Vent Valve is suspected, disassemble the valve and remove any debris.

[Refer to the Components section for resistance test procedure]

MIDMARK

The Fill Valve is located on the right side of the unit. This valve is closed until it is energized.

During the Fill Mode, the PC board supplies line voltage to the Fill Valve. This opens the valve, allowing water to flow into the chamber.

When water reaches the water level sensor inside the pressure vessel, a circuit is completed and current flows back to the PC board. When this voltage is detected, the PC board stops the current flow to the Fill Valve. This closes the valve, stopping the flow of water into the pressure vessel.

Service Tip

Debris trapped in the Fill Valve may prevent the valve from opening or closing properly. If a faulty Fill Valve is suspected, disassemble the valve and remove any debris.

[Refer to the Components section for resistance test procedure]

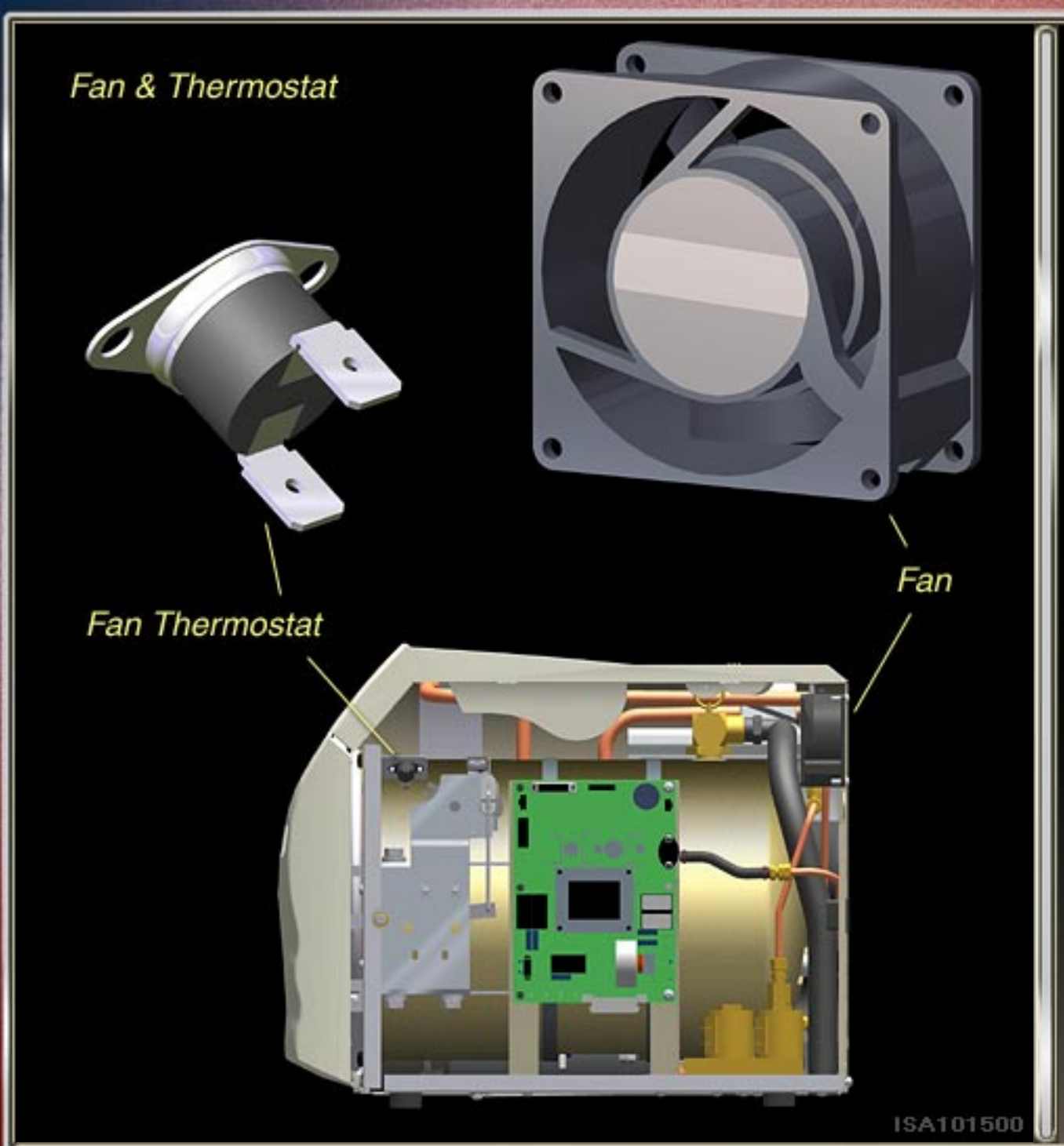
MIDMARK

The Door Switch is mounted to the lower latch bracket in the front of the sterilizer.

This switch closes when the door is latched. The PC board continuously monitors the status of the Door Switch during operation. If the door opens during the Fill, Heat-Up, or Sterilization Modes, the PC board detects the open switch and terminates the cycle.

[Refer to the Components section for continuity test procedure]

MIDMARK



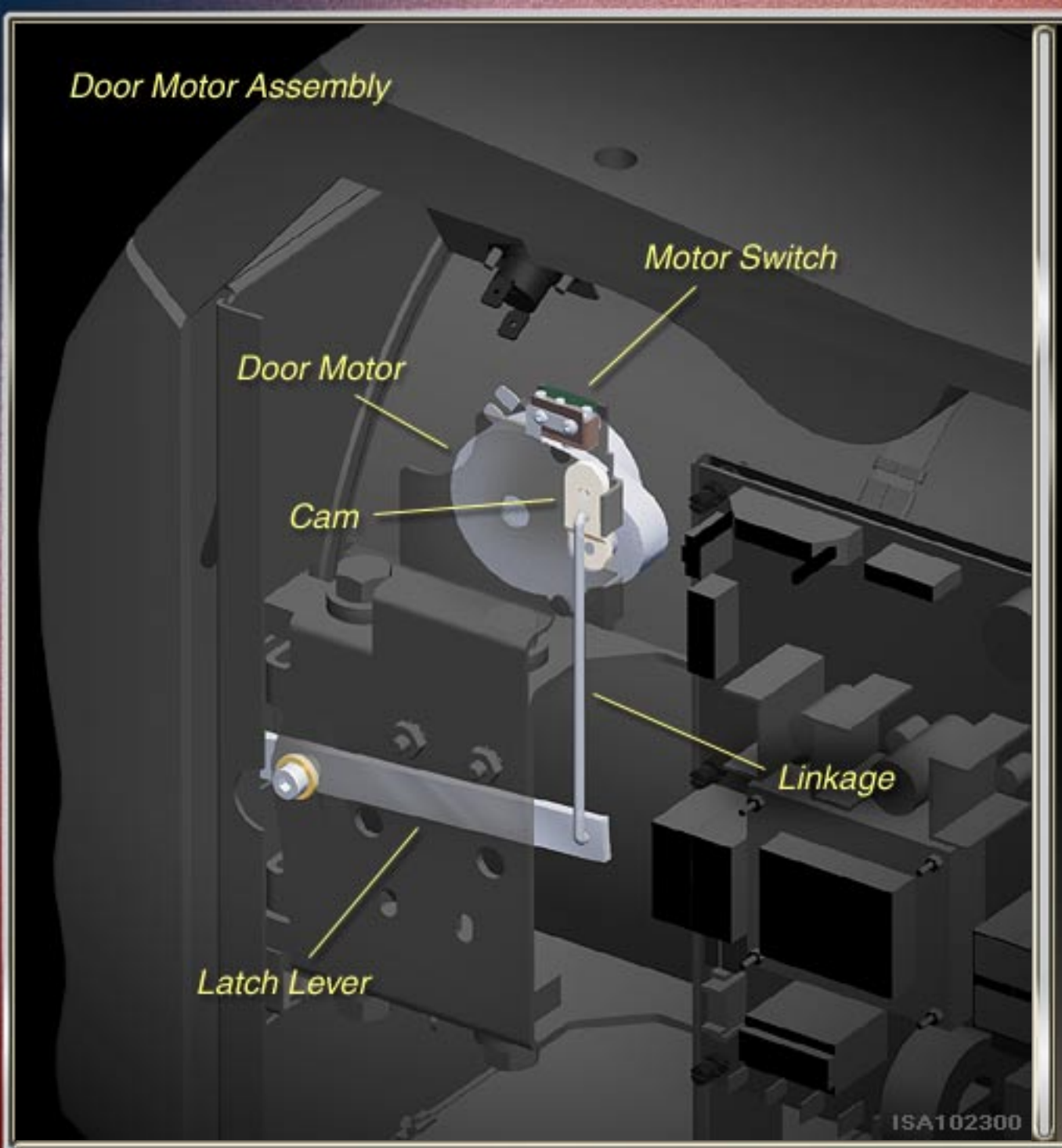
The Fan is mounted to the back cover of the unit. The Fan Thermostat is mounted to the top of the chamber at the front of the unit.

The purpose of the Fan is to reduce heat inside the enclosure by circulating air between the chamber and the covers.

The ON / OFF function of the Fan is controlled by the Fan Thermostat. When the temperature reaches 130°F ±8° (54°C ±4°), the Fan Thermostat contacts close and current flows to the Fan. This causes the Fan to run.

When the temperature drops to 101°F ±6° (38°C ±3°), the Fan Thermostat contacts open and the Fan stops running.

[Refer to the Components section for resistance / continuity test procedures]



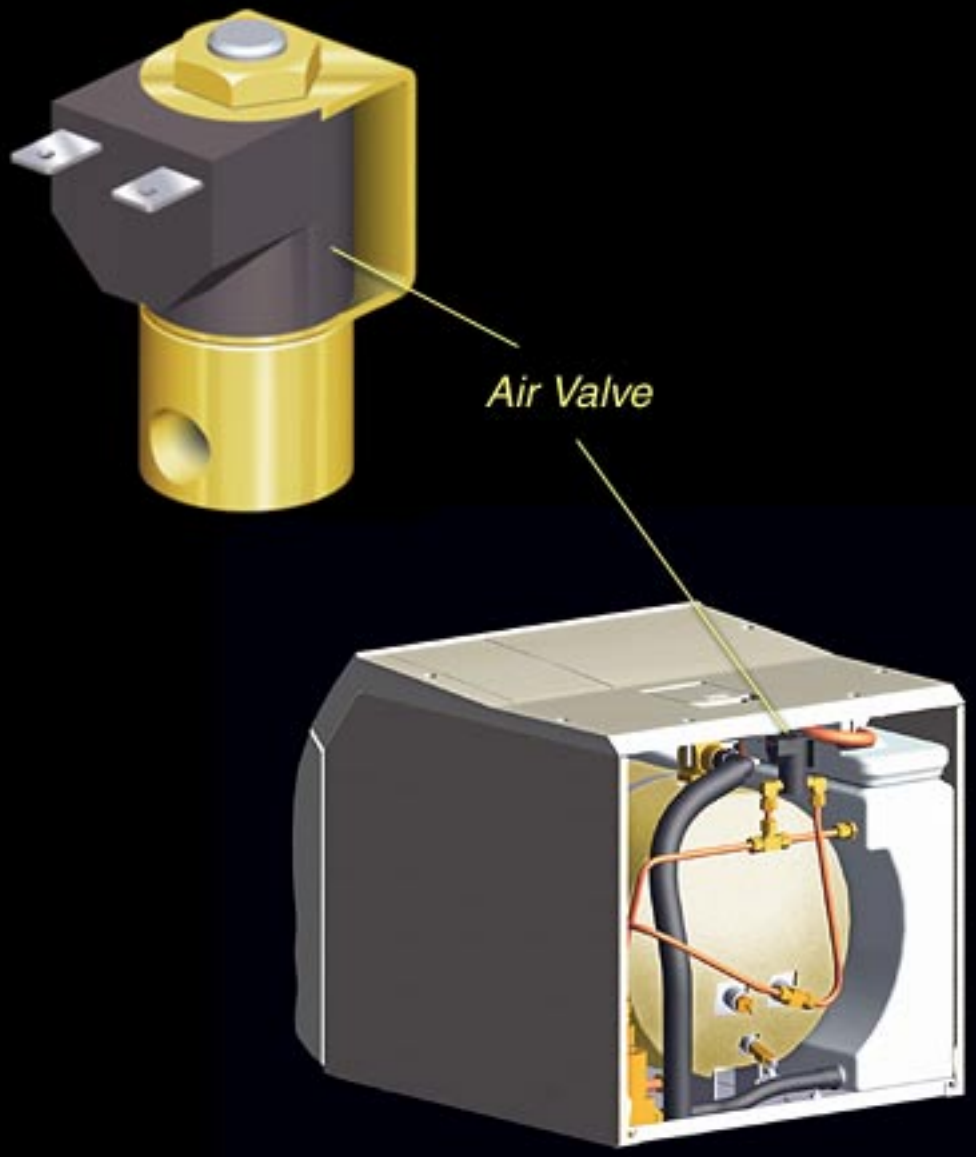
The Door Motor Assembly is located on the right side of the unit. This mechanism automatically opens the door after the Vent Mode.

When the pressure in the chamber reaches 0.7 PSI (5 kPa), the PC board bypasses the Motor Switch and energizes the Door Motor. The Door Motor rotates the Cam causing the Motor Switch to close. Now the current to the Door Motor flows through the Motor Switch. As the Cam rotates, the Linkage causes the Latch Lever to open the door.

When the Cam reaches the bottom of its travel, the motor reverses direction. When the Cam reaches its original position, the Motor Switch opens, stopping the current flow to the Door Motor. This causes the motor to stop running.

[Refer to the Components section for resistance test procedure]

MIDMARK



The Air Valve is located in the back of the unit.

During the Fill Mode, the PC board supplies line voltage to the Air Valve. This causes the valve to open so that water can flow into the chamber.

When the Heat-Up Mode begins, the PC board stops the current flow to the Air Valve. This closes the valve. The PC board opens the Air Valve three times during the Heat-Up Mode to release air from the chamber.

During the Sterilization, Vent, and Dry Modes, there is no current flow to the Air Valve. This causes the valve to remain closed.

[Refer to the Components section for resistance test procedure]

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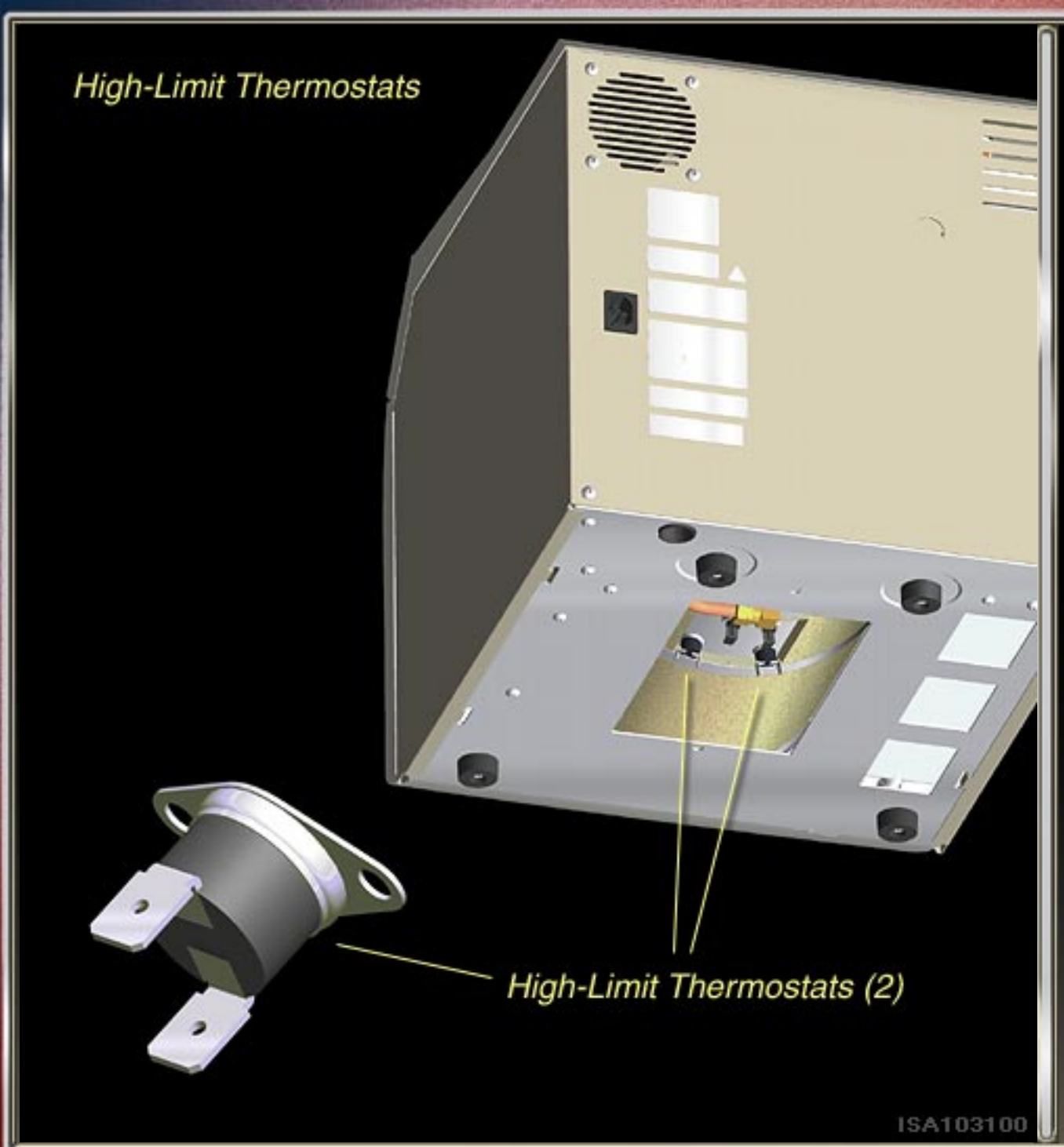

The two High-Limit Thermostats are mounted to the bottom of the chamber.

Throughout the entire cycle, current flows through the normally closed contacts of the thermostats. This circuit powers all of the line voltage components, except for the Fan.

If the temperature at either of the thermostats exceeds 450°F ±25° (232°C ±14°), the thermostat contacts open. This interrupts power, and the cycle is terminated.

The thermostat contacts reset to the closed position at approximately 325°F (163°C).

[Refer to the Components section for continuity test procedure]

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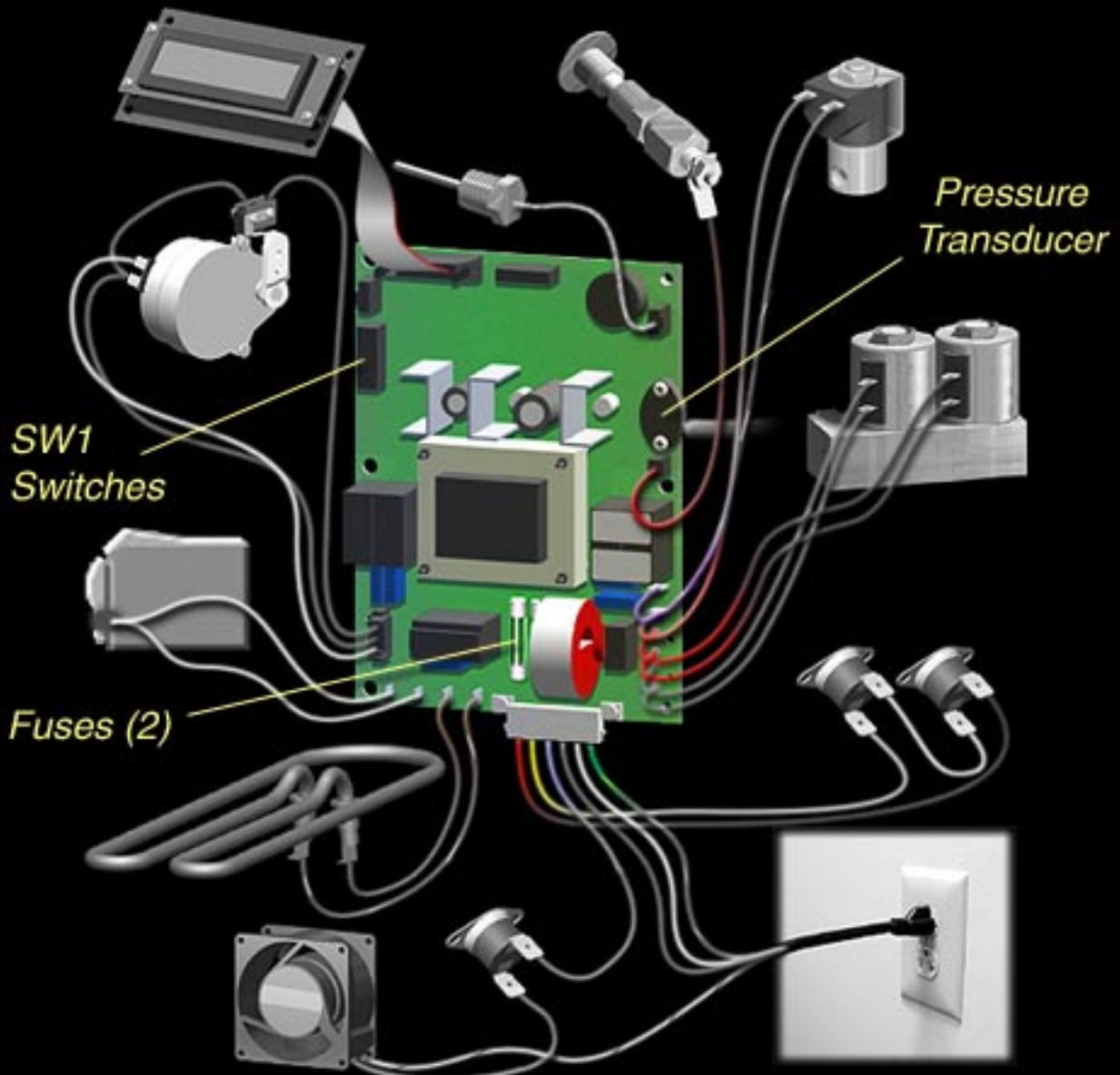

The Main PC Board controls all of the electronic components of the sterilizer. During operation, the Pressure Transducer monitors the chamber conditions to maintain the parameters for the selected cycle.

The two Fuses on the PC board (F1 and F2) protect the circuitry from excessive current draw. If either Fuse is faulty, the unit will not operate.

The SW1 Switches can be used for service diagnostic and to adjust the display to metric units.

[Refer to the Components section for test procedures]

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Error Code Reference Table

First Digit=Component	Second Digit=Problem	Third Digit=Mode
0=General System	0 (not used)	0=Power-Up
1=Stop Button	1=Power Loss	1=Select Cycle
2=Water Level Sensor	2=Closed	2=Fill
3=Door Switch	3=Low	3=Heat-Up
4 (not used)	4=High	4=Sterilizing
5=Temperature Sensor	5 (not used)	5=Vent
6=Pressure Sensor	6=Hardware	6="Door To Open"
7 (not used)	7=Over Limit	7=Dry
8 (not used)	8=Open	8 (not used)
9=High-Limit Thermostat(s)	9 (not used)	9 (not used)

Use this table to cross-reference the numeric error code with the *Component*, *Problem*, and *Mode* in which the error occurred.

Refer to Section II in the service manual for troubleshooting information.

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